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MECHANICAL ENGINEERING

January 1944

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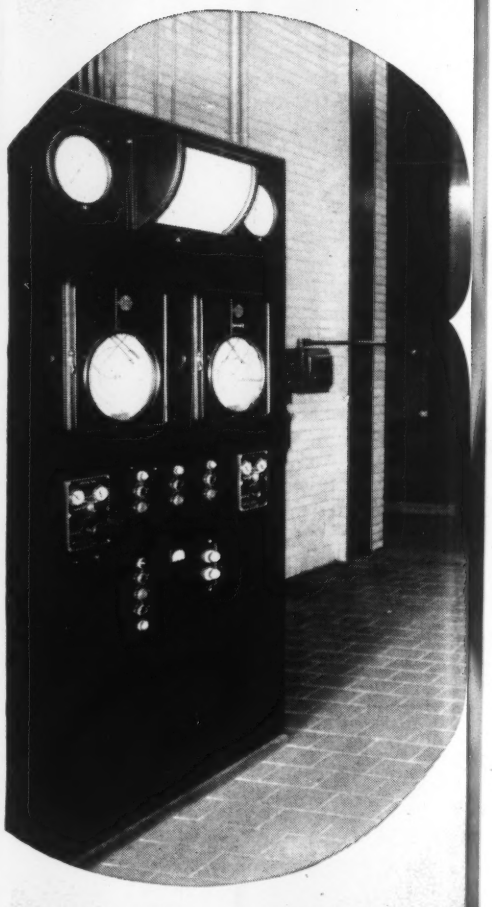

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MECHANICAL ENGINEERING

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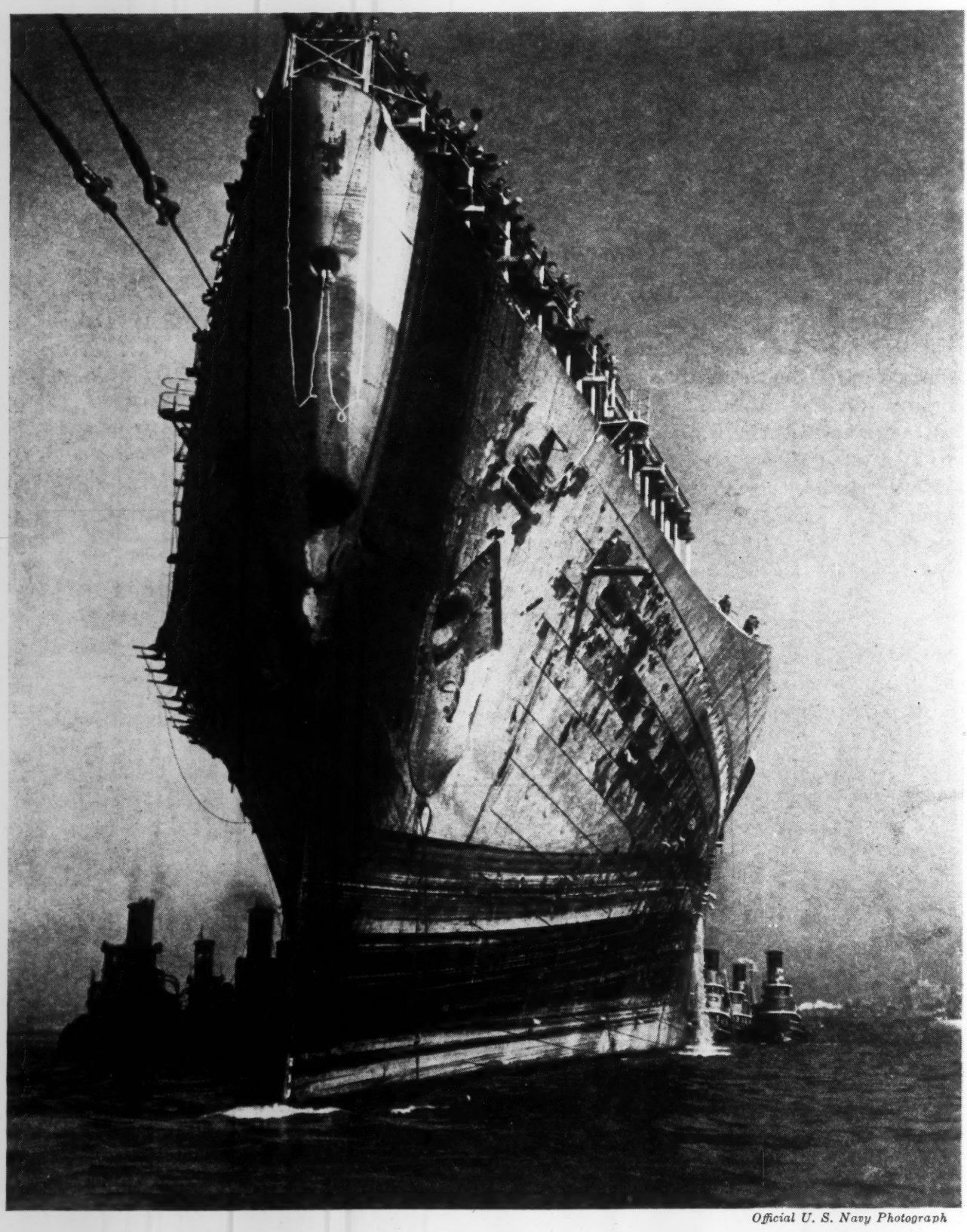


Official U. S. Navy Photograph

The Righted U. S. S. "Lafayette" Moves to Drydock

(*For salvage operations see article by Capt. B. Manseau on "The Raising of the U. S. S. "Lafayette," pages 5-12.*)

VOLUME 66
No. 1

MECHANICAL ENGINEERING

JANUARY
1944

GEORGE A. STETSON, *Editor*

Help Save and Conserve Paper

WHILE the Committee on Publications of The American Society of Mechanical Engineers continues to wrestle with the serious problem of the paper shortage as described in these pages last month, there have come to notice through W.P.B. agencies two ways in which members themselves can be of assistance in stretching out the inadequate stocks of wood pulp from which publishers and other users of paper must draw their raw materials—conservation and salvage.

The conservation campaign, according to the O.W.I., in which W.P.B. and O.W.I. will co-operate with the War Advertising Council, publishers, and manufacturers, has two objectives: (1) To conserve the use of paper by the American businessman in his plant and office, and (2) to effect savings through packaging or industrial use of paper. Enormous amounts of wastepaper, says O.W.I., that could be put back into production are still being discarded in many shipping and receiving departments, warehouses, and offices. Economic wrapping and packaging can be practiced in every business.

On the salvage side, it is said, better co-operation between industry and W.P.B.'s Salvage Branches is needed if 8 million tons of wastepaper per year—the minimum requirement—are to be collected. Says O.W.I., industry can contribute much desirable paper in the form of cartons, corrugated paper, wastebasket paper, file material, and catalogues.

Here are opportunities for all A.S.M.E. members to help conserve and salvage supplies that may release more paper for their publications.

Named for Engineers

FIVE ships of the United States Maritime Commission are to be named for engineers, according to a recent announcement made jointly by The American Society of Mechanical Engineers and The Society for the Advancement of Management. All five, in their lifetime, were members of A.S.M.E. The men so honored are:

Frederick W. Taylor, father of scientific management, who laid the foundations of modern management principles and practices and was the first to make a comprehensive study of the art of cutting metals.

Frank B. Gilbreth, whose work in time and motion study opened new and fruitful fields of increasing production with the reduction of fatigue.

Harrington Emerson, whose "twelve principles of Scientific Management," became household phrases a generation ago.

Henry L. Gantt, the great philosopher and protagonist of modern management and champion of the working man, who, by means of the Gantt chart, brought orderly procedure to production.

John Edson Sweet, inventor, engine builder, and educator, who had "to invade the ranks of foremen and machinists" to recruit his staff and whose most lasting honor was "his influence over men, to cause them to think straight and live honorably."

In a letter to the presidents of the two societies through whom the announcement was made, John M. Carmody, commissioner, United States Maritime Commission, and chairman, Ship Naming Committee, wrote:

"I am sure both of you realize that to a much greater extent than is commonly appreciated much of the magnificent job of production of essential war materials that we are proud of having done during the past year or two is due in large measure to the foundation that was laid for better management techniques by the men whom we are honoring. It is for this reason that, wholly apart from the contributions they made to industry during their lifetime, I think it is fitting that ships that carry these supplies to our fighting forces all over the globe should bear their names."

In the ports of the Seven Seas men will read these names and wonder what they signify: Victory first for the United Nations as the result of untiring efforts of obscure workmen who day by day back up the heroic efforts of their brothers in the field—and after victory, the rebuilding of a war-torn world where the principles of sound management, the philosophy of an industrialized civilization that has come to respect human values, the quest for the "one best way," and that benign influence that causes men to think straight and live honorably shall inspire men with new courage and a new hope to work out their destinies in accordance with the fundamentals these engineers discovered and put into practice.

Faith in the Engineer

IN his A.S.M.E. presidential address, which will be found on pages 29–31 of this issue, Harold V. Coes has given a long list of the wartime research and development projects from which rich peacetime dividends may be expected. The character of the address is reminiscent of those which the first president of the Society, Robert Henry Thurston, used to deliver more than sixty years ago. No doubt Dr. Thurston's optimistic predictions sometimes sounded fantastic to many readers, and yet most of them—the airplane, for example—are common enough today.

So accustomed have we become to new marvels that we have come to expect scientists and engineers to make

good their most optimistic dreams and to spring on us new products and scientific aids beyond the reach of a layman's imagination. There is a confidence in the public mind that each new problem that confronts us will generate an easy solution—in war, a secret weapon or counter weapon—in peacetime, the defeat of a menace to health or the basis of a new industry to revive a flagging economic virility. We have become a nation which looks for miracles.

Never before in our history has the engineer found himself perched on so high a pinnacle of public esteem. Never before has the nation looked with such confidence and anticipation to the engineer for superior performance. Never before has the engineer so well deserved this esteem and this confidence. The war has provided him with stimulus and opportunity for achievement. Will the conditions of peace after victory make it possible for the engineer to maintain his present position of high esteem?

The overenthusiastic postwar planners have given many conscientious and thoughtful engineers great concern lest the public be led to expect too much too soon. Wartime restrictions on the full disclosure of scientific and engineering advances have aroused many false expectations of what we may have offered to us by industry and engineering once the reconversion to a peacetime economy is well under way. Protagonists of new materials, new methods, new gadgets, new industries have hinted broadly of wonders apparently already at hand for public enjoyment. Engineers and the workers in research laboratories are more conservative. They know, only too well, the long road that lies ahead of developments on their road to public acceptance; they have experienced the setbacks and disappointments that obstruct the pathways of progress; they have faced the hazards of competition and the vicissitudes of false hopes, false starts, and unfavorable economic, social, and political environments; their objective minds have learned that engineering success depends on commercial success, that cost and psychological factors must be weighed in the balance with correct scientific principles and acceptable engineering design.

If the engineer is to maintain his position of high esteem in the eyes of the public, some of the wishful thinking of the postwar planners must be counterbalanced with patience, and the environment necessary to bring new developments to fruition must be established and nourished. The engineer cannot be held entirely responsible for the delays that may be encountered. He alone cannot control the forces that will be brought to bear on our economic life during the period of reconversion in the postwar era. He must work within the framework of history as it develops from day to day and not within an ideal framework of economic and social conditions as he would have them.

It is important that the public understand some of the limitations to engineering achievement. Not that the engineer will rest on the laurels won during this greatest of all wars or that he will fail to do his part in establishing and maintaining the conditions favorable to even greater achievements. In the final analysis it will be the public themselves, which includes engineers, and their leaders which will determine how quickly and how well engineers may serve their fellow men.

Without having shaken its fist in the face of the public to demand its "rights" the engineering profession enjoys the satisfaction of the greatest degree of public esteem and confidence it has ever known. It has its periods of inflated self-importance and of self-commiseration born of inadequate rewards. Fundamentally, however, it will do well to continue to cherish that ideal of "simple service, simply given," sometimes derided in a highly competitive and self-centered materialism. The world must not lose faith in the engineer, either because it expects too much of him or because the engineer is too impatient of rewards overdue.

"Engineers' Digest"

WITH a note of appreciation and encouragement, Harold V. Coes, president A.S.M.E., 1942–1943, has welcomed to the company of technical magazines published in this country the American edition of the *Engineers' Digest*. The English edition of this magazine of condensations of technical articles published abroad has been well and favorably known to a few engineers in this country. MECHANICAL ENGINEERING has, from time to time, drawn upon the abstracts of translated articles published in the *Digest* for its own abstract department, "Briefing the Record," and articles appearing in MECHANICAL ENGINEERING have appeared in condensed form in the English edition of the *Digest*. Thus there have always been close and cordial relations between the two publications. MECHANICAL ENGINEERING wishes to take this opportunity to second Mr. Coes' message of good wishes and to express the hope that the *Digest* will assist engineers in this country, particularly those engaged in research, development, and design, in keeping in touch with the cream of the engineering periodical literature of Great Britain and the Continent.

Forty Years Ago

FORTY years ago to the very day on which this is written, two American inventors made the first successful flight of a power-driven airplane. Staying in the air for 12 seconds on the first flight and for 59 seconds on the third of that memorable day, the Wright Brothers demonstrated the ability of man to conquer heavier-than-air flight and initiated an era in transportation that has profoundly changed the character of war and the relations between man and nations in times of peace.

Under the impetus of two wars the history of aviation has made two spectacular forward surges. Immediately following the first of these surges, interest, and to some extent faith, in the peacetime usefulness of the airplane languished. During that twilight The American Society of Mechanical Engineers, almost alone among engineering societies, nurtured the technological aspects so necessary to sound progress in aviation.

As later developments placed on a firm foundation the great industry which, in the present war, is providing the means of victory for the United Nations, the faith of A.S.M.E. was justified. Today the Society honors the great event at Kitty Hawk and the surviving inventor, Orville Wright, elected an Honorary Member in 1918.

THE U. S. S. "LAFAYETTE" IS TOWED TO DRYDOCK[1]

The RAISING *of the* U. S. S. "LAFAYETTE"

Salvage Operations on the U. S. Transport, Formerly the French Liner Normandie

By CAPT. B. MANSEAU, U.S.N.

SUPERVISOR OF SALVAGE, UNITED STATES NAVY

As IS often the case in salvage projects of the nature involved in raising the U.S.S. *Lafayette* (formerly the *Normandie*), the fundamental principles of the method employed to right and refloat the vessel were simple, but the detailed developments of the engineering features of the plan and, more important, the solution of the many organizational and practical problems which arose in accomplishing the actual details of the work upon which the success of the entire operation depended were considerably more complicated.

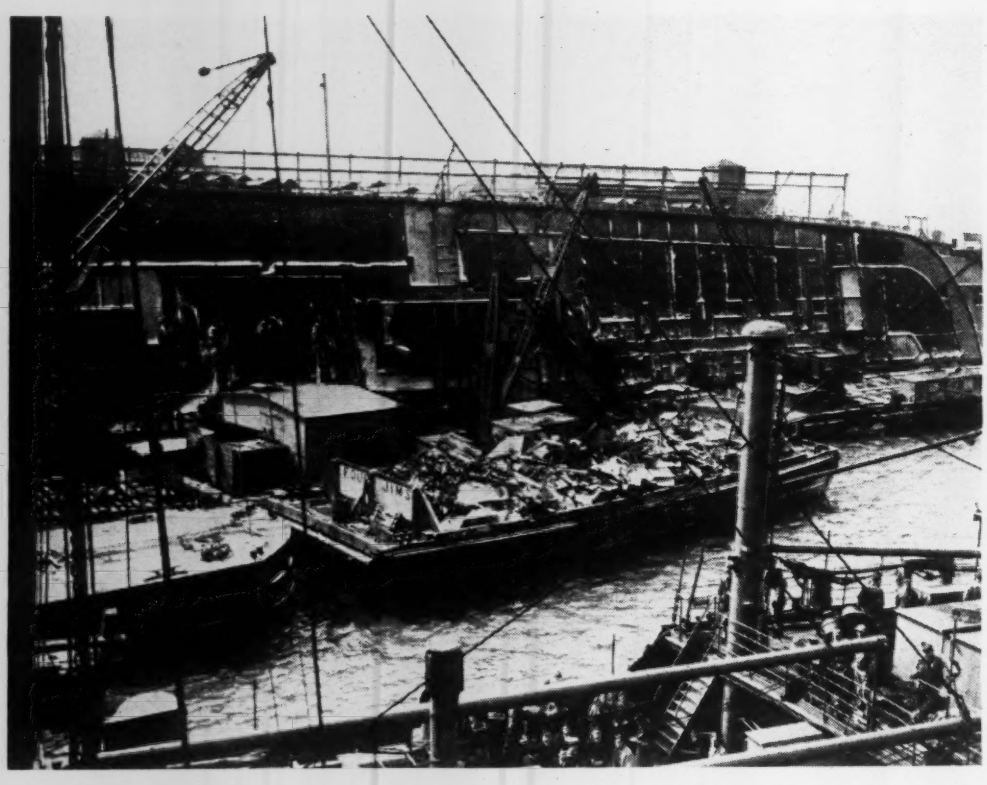
The successful accomplishment of this tremendous project was the result of co-ordinated effort on the part of the entire organization, which, in turn, was influenced by its key members, including T. A. Scott, chairman of the Board of Merritt-Chapman & Scott, who was very active in the *Lafayette* project from its beginning, and who contributed materially to the decision to attempt salvage; Capt. W. N. Davis, vice-president in charge of the Salvage Division of Merritt-Chapman & Scott, whose character and spirit permeate the entire organization; A. C. W. Siecke, who conducted the naval architecture and engineering studies and calculations; and J. I. Tooker, known by his contemporaries as "Captain" Tooker, salvage officer in charge of the job for Merritt-Chapman & Scott.

Although the salvage was accomplished by the entire organization, including an average of 700 workmen, each doing an important part, the success of the job depended essentially on the work of the divers. The controlling work, upon which the preparation of the ship for pumping was dependent, had to be performed by divers under water by sense of touch and

[1] Illustrations used in this article are U. S. Navy Official Photographs.

Contributed by the Marine Power Division and presented at a Metropolitan Section Meeting of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS, in which members of The Society of Naval Architects and Marine Engineers participated, New York, N. Y., October 27, 2943.

NOTE: The opinions contained herein are those of the author and are not to be construed as official or reflecting the views of the Navy Department.



REMAINS OF A RECENT SNOW FLURRY CLING TO EXPOSED PORTIONS OF DECK IN FEBRUARY, 1943
(Salvage scows are loaded with debris from underwater compartment of the ship.)

judgment alone, because visibility in the muddy water was zero. An average of 70 divers per day were employed.

The entire project can be divided into the following phases:

1 Preliminaries leading to the decision to attempt salvage and the development of the general plan.

2 Preparation of the detailed plans and the long period of preparation for pumping.

3 Pumping.

4 Cleaning the vessel out, preparatory to delivery for rebuilding.

PRELIMINARY EVENTS AND CONSIDERATIONS

Prior to the capsizing, the *Lafayette* was moored at Pier 88, North River, undergoing conversion into a troop transport. The work was well under way; the ship was shortly expected to depart on its assigned mission. At about 2:30 p.m., on February 9, 1942, a fire broke out in the grand lounge above the promenade deck where 1100 bales of life preservers had been assembled prior to distribution throughout the vessel. The fire, fanned by a strong northwest breeze, swept throughout the entire superstructure, until shortly the three upper decks were enveloped in flames or in smoke. A combination of circumstances, resulting from initial attempts to extinguish the fire, caused the ship to capsize. It is estimated that the initial metacentric height was about $^{9}/_{10}$ ft and the metacentric radius (BM) about 28 ft. Hence impairment by $^{1}/_{28}$ of the moment of inertia of the intact water-plane area, due to the free surface of the water poured on the ship to extinguish the fire, was all that was necessary to reduce the metacentric height to zero. In addition, water on the topside contributed to this reduction by raising the center of gravity. The loss of initial stability caused the ship to take a list to port and, when the list reached about 13 deg, sea water flowed into open cargo ports and then into air ports, until about 2:30 a.m. on the following morning, February 10, the ship capsized, coming to rest on the bottom at an inclination of about 70 deg.

The capsized ship rested in the slip between Piers 88 and 90, with the forefoot about 180 ft north of the inboard edge of Pier 88, and the rudder at the stern protruding under Pier 88 about 5 ft. At mean low water, the keel forward was about 5 ft below water, and the ship trimmed slightly by the stern so that the after end of the keel was about 13 ft below mean low water.

Explorations were started immediately to determine the nature of the ship's bearing on the bottom. It was found that the ship lay in a bed of soupy mud from about —26 ft down to about —35 or —40 ft. It was also found that a rock ledge at about —46 ft extended from the Manhattan end of the slip toward the river, to a point at about one third of the length of the ship from the bow. From this the rock ledge sloped down steeply into the river bed so that at the stern, soil of varying densities extended to a depth of well below —100 ft. It therefore appeared that the ship was supported somewhat throughout by soft river silt, by a hard point at the edge of the rock ledge, and by more or less firm soil aft. It should be noted that amidships, the port side was nearly 60 ft below mean low water.

Because of the location of the wreck in New York City, the investment represented in labor and material, the publicity the ship had received both as a liner and because of its possible use in the war, and the doubtful circumstances surrounding the fire and capsizing, the disaster was constantly in the public eye and aroused considerable comment from the press and the general public. Consequently, it was necessary to exercise the greatest degree of caution and the best of judgment in determining what disposition was to be made of the wreck. In April, 1942, the Secretary of the Navy appointed a special committee to investigate the situation and make appropriate recommendations. Although the committee itself included experts in such matters, many other experts were questioned in an endeavor to explore all the possibilities and to arrive at the most practical solution.

Expert opinion indicated that complete removal of the hulk both above and below the water would cost a prohibitive amount, and probabilities as to future use and development of the slip precluded leaving any appreciable portion of the wreck embedded in the mud. The idea of cutting it up where it lay was therefore abandoned, early in the deliberations. Likewise, methods of salvage involving construction of cofferdams around the ship or the application of external forces through mechanical devices were abandoned because conditions would not permit their use at a reasonable cost in time and money. Also, these methods, even if successful, offered only partial solutions, because the fact still remained that the vessel had to be cut up or floated out.

It was finally concluded that if the vessel could be salvaged at all, the fastest, most certain method of accomplishment was to seal all underwater openings and to right and refloat the vessel simultaneously by a single pumping operation. Preliminary estimates indicated that this could be done in some 18 to 24 months, at a cost of five to six million dollars.

DEVELOPMENT OF THE PLAN AND PREPARATORY WORK

It was planned to undertake the work of salvage, utilizing the services of Merritt-Chapman & Scott Corporation under the provisions of the Salvage Service Contract, NObs-36, whereby the entire Salvage Division of the Corporation was at the disposal of the Navy Department. However, it appeared that this job would be of such magnitude that a separate organization would have to be set up to handle it, using a minimum number of key members from the Salvage Division in order not to interfere with the extensive salvage operations then being conducted in coastal waters resulting from marine and war casualties. Using the very few key members assigned to the job, the first major problem confronting Captain Tooker and the Supervisor of Salvage was to build up an organization around these men.

WELL OVER THE HALF-WAY MARK IN THE COMPLETION OF SALVAGE OPERATIONS
(Work continues in constructing concrete sections and in closing all pipe lines leading from one compartment to another.)

During the period from the time the vessel capsized until orders were received to proceed with salvage, work on the vessel was restricted to removing the superstructure, fire hazards within the ship, the installation of scaffolding throughout for access into the ship, and the explorations of certain unknown conditions which held the possibility of salvage in the balance.

Actually, the possibility of salvage by pumping, or probably by any method, depended primarily on the soil upon which the aft portion of the ship rested; ultimately developing enough bearing value to resist settlement by the stern. Nature solved this problem when the vessel ceased to settle appreciably in about 6 months, during which time it has settled about $3\frac{1}{2}$ ft.

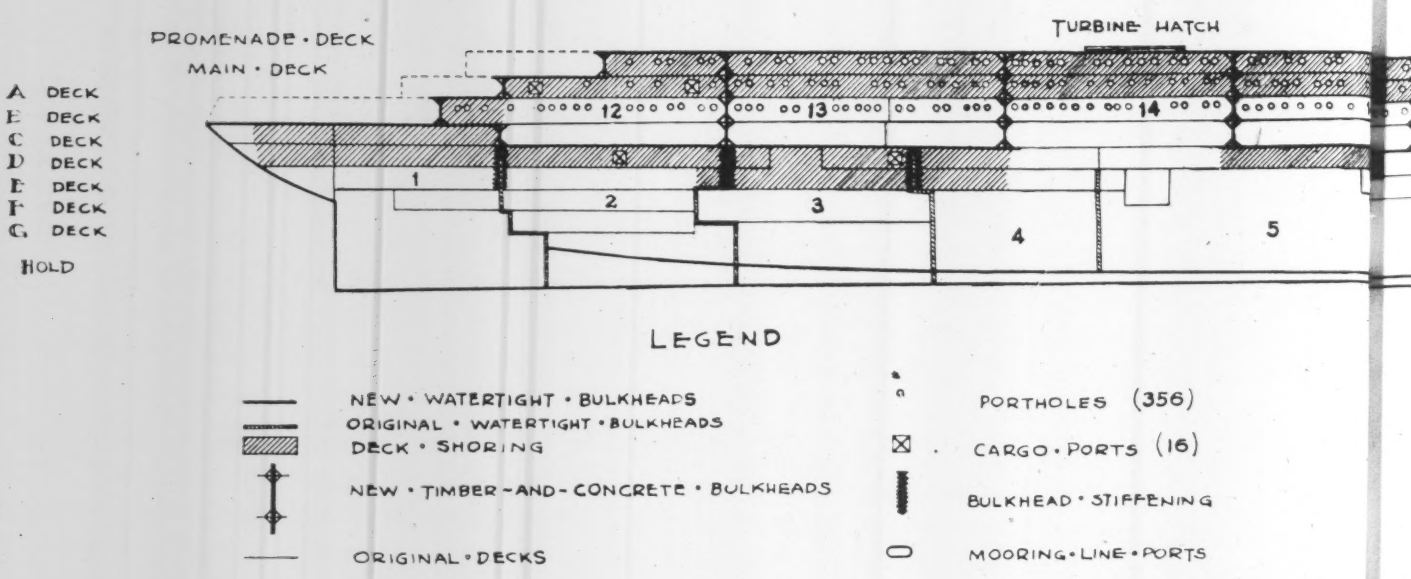
Next, salvage depended upon the possibility of removing the mud in way of open ports, 60 ft down, long enough to permit divers working from the inside to seal them without undermining the soil bearing to the extent of causing failure and consequent settlement of the ship. The fluidity and depth of the mud made it absolutely impossible to close the ports from the outside. After 4 months of constant effort to remove the mud in way of the most critical cargo port by use of air lifts, during the greater part of which time it appeared that mud entered the ports from the outside as fast as it was pumped from the inside, the soil became firm enough to permit the excavation of a cave around the port long enough ot permit its being closed. This was the most critical and decisive point in the operation. Therefore, the possibility of salvage was largely hope; afterwards it was a matter of time and hard work in performing the multitudinous details involved in sealing and subdividing the structure.

Finally, it was necessary to be certain that the relationship between the center of gravity and the center of buoyancy would permit righting and floating by pumping alone. It was calculated that with the superstructure removed, the lever arm from the axis of rotation through the low bilge to the center of buoyancy could always be kept greater than the lever arm to the center of gravity. The total displacement of the ship at mean low water was about 103,000 tons and at mean high water about 115,000 tons, which was, of course, ample to float the bare vessel containing about 50,000 tons of structure and installations.

The details of the final plan of salvage were developed during the 17 months, as the work progressed. However, the main feature of the plan crystallized early in the operation and was initially as follows: In order to control the inclination, trim, center of buoyancy, the center of gravity, as well as to insure both transverse and longitudinal stability during pumping, it was decided to subdivide the underwater portion of the ship into 14 main watertight compartments, some extending from the keel to the promenade deck and some having an intermediate deck, such as "C" deck, as one of the boundaries. The location of the boundaries of the compartments was the result of compromises between desired engineering considerations and practical considerations involved in making these boundaries tight. Several times throughout the long period required to prepare the ship for pumping, changes in details of the subdivision had to be made to overcome otherwise insurmountable practical difficulties. Once the degree of subdivision had been determined, it was necessary to make laborious calculations showing the effect on soil bearing, on center of gravity and center of buoyancy, on stability, and so on, of various quantities of water in the different compartments at various angles of inclination. This required that various assumptions be made and the use of cut-and-try methods with attendant backing and filling throughout the studies. There were so many unknown factors, that a wide range of possibilities had to be computed and data assembled in such form that the tentative pumping plan adopted at the start could be modified quickly to meet actual conditions encountered.

Likewise, the choice of shoring and strengthening of the bulkheads and decks as required to withstand the expected hydrostatic pressures was governed by the probable pumping required.

Although the calculations involved in the development of the general plan were very laborious and important, the success of the entire plan, of course, depended upon the ability of the



SECTIONAL VIEW OF

outside force to carry it out, which, as indicated previously, involved a tremendous amount of underwater work which was necessarily not susceptible to inspection by the topside supervisors. It depended largely upon the mutual confidence between the divers and the supervisors and the supervisors' judgment of, and the control they could maintain over, the divers.

The main items of preparatory work on the ship consisted of the following:

1 Removal of the superstructure above the promenade deck, both above and below the water line.

2 Removal of all inflammables above the water line and the partitions, furniture, huge masses of debris, and mud which had accumulated on the port side below the water line as the vessel capsized.

3 Closing and sealing 16 cargo ports, 356 air ports on the port side, trimming the promenade deck, and closing all openings therein below the water line.

4 Making the boundaries of the 14 compartments watertight, including the installation of the necessary timber and concrete bulkheads.

5 Shoring and strengthening the decks and bulkheads which would be required to withstand pressure.

6 Installing salvage pumps, together with the necessary suction, discharge, and exhaust piping.

7 Removing a portion of the pier at the outboard end against which it appeared the ship would foul as it rotated about its submerged bilge keel.

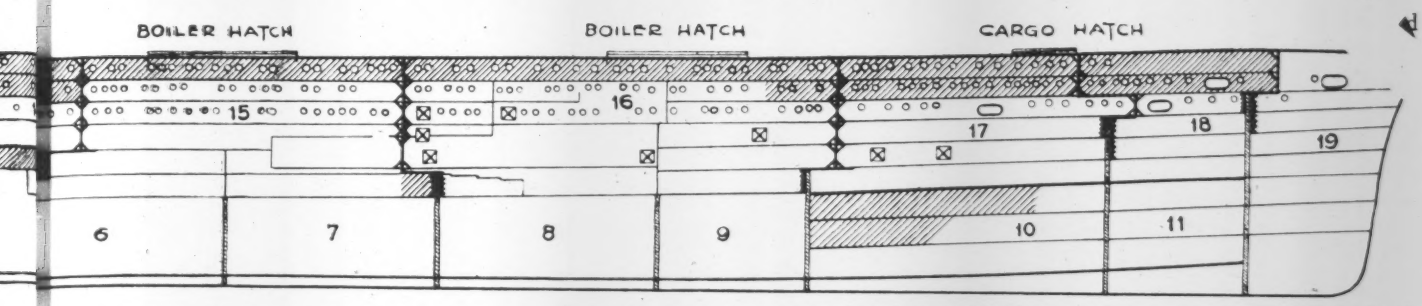
In connection with both the design work and the production work on the job, it is important to note that with approximately one half of the vessel above the water line, a study of the portion of the ship above the water gave a good indication of the structure below. There were a few difficulties which arose, however, incident to the lack of symmetry in some respects.

About 5000 tons of superstructure were removed; a little less than one half of this was above the water line, while the remainder was below and had to be removed by underwater burning and ripping. A section of about 800 tons was embedded so deeply in the mud that it could not be removed. It is interesting to note, during the removal of the 5000 tons of superstructure, the ship righted itself a fraction of a degree, indicating that a natural tendency existed for the ship to rotate in the proper direction.

While the foregoing work was in progress, the work of removing inflammables in the interior, cleaning out both above and below water, progressed. Roughly, 6000 tons of debris and scrap were removed from the interior, including about 8000 lb of broken glass; also about 10,000 cu yd of mud which had entered through the portholes were removed. As can be visualized, immediately after capsizing, the interior of the ship was a mass of wreckage; all loose furniture and fittings fell to port, glass and other light paneling was broken, decks were vertical, longitudinal bulkheads were horizontal. It was a tremendous job to clear out the wreckage and remove the light structure, which presented either a fire hazard or a safety hazard to the workmen. Horizontal structures which often appeared solid would not support the weight of man; all this had to be removed, and walkways, ladders, and scaffolding installed before any heavy traffic could pass. During the first year or more, a large part of the work was directed from and served by a plant in Pier 88 and on top the starboard side of the vessel. Cargo hatches and passageways, then vertical, were used as shafts through which to hoist out material removed. Hundreds of barge loads of scrap and trash were carried away. Scrap steel was weighed and sold; the weight of mud and unsalable scrap and debris was estimated. Reasonably accurate records were kept for use in calculating the final center of gravity.

Removal of structure and debris below the water line was carried out primarily for the purpose of permitting access by the divers to the numerous cargo and air ports which had to be closed from the inside, and to permit the installation of timber and concrete bulkheads. In some cases mud and trash had built up on the port side of the ship to a depth of 10 to 20 ft. Most of this had to be removed. After removal, divers working from the inside were able, in due course, to excavate the mud around the cargo ports long enough to pull the doors inboard and secure them with strongbacks so that no further mud entered. Subsequently dams and forms were built around the cargo ports, reinforcing members placed, and the ports sealed by a backing of reinforced concrete poured either by hand from bags or by the Tremie process. In a similar manner, access had to be gained to each and every air port. One diver working continuously for almost a year sealed each and every port by slipping through a folding patch which was then opened and drawn in against a gasket, secured by a strongback from the inside, and sealed and strengthened by concrete poured from bags onto the inside of the port.

The location of the internal boundaries of the watertight compartments was chosen with due regard to the existing structure. Original watertight bulkheads and decks were used wherever feasible. The bulkheads, however, in most cases extended only up to "E" deck. In view of this, it was necessary



(This diagram of the *Lafayette* with superstructure removed represents a considerable portion of the underwater construction work undertaken by the salvor in order to make final pumping operations and righting possible. It was decided to subdivide the underwater portion of the vessel into 19 separate watertight compartments. This scheme was amended and a few compartments were made common, for example Nos. 16-8-9. In order to accomplish this, new timber and concrete bulkheads had to be constructed by divers. Three-hundred-and-fifty-six portholes and 16 large cargo ports had to be closed—many of them were 20 ft in the mud. In order that bulkheads between compartments would be able to withstand the differential pressure resulting from different water levels in adjacent compartments, and in order that the promenade deck withstand the great water pressure as the inside compartments were unwatered, the extensive shoring indicated on the diagram was found necessary. In the low-numbered compartments the vessel's existing watertight bulkheads made compartmentation fairly easy. Not shown above: Numerous openings in the promenade deck had to be trimmed and patched by enormous wooden and steel patches. Ninety-three salvage pumps placed in the compartments controlled the water level in each. By this so-called method of controlled pumping the vessel was rotated from its position at 79 degrees inclination to a position of about 45 degrees inclination, with the turn-of-the-bilge of the vessel still resting on the bottom. The pumping procedure was then changed so that the vessel floated at 45 degrees. Once the vessel was afloat it was hauled into the middle of the slip and the remaining water pumped out.)

U.S.S. LAFAYETTE

to extend such bulkheads up to the promenade deck which meant the construction of temporary timber and concrete bulk-heads from the waterline down to the port side between each pair of the various decks, i.e., promenade, A, B, C, D, and E.

Having chosen the location of these bulkheads, it was necessary to strip completely everything in the way of all obstructions, which again included sheathing, wiring, vent ducts, partitions, and miscellaneous other material right down to the ship's side, in many cases about 60 ft below. This, again, involved a tremendous job for the divers. Having cleared the way, vertical guide bars or bounding bars were secured to the original topside of the deck on the one side, and to the original overhead on the other. (In the case of the overhead, deck beams were in most cases used as bounding bars.) The bulkhead consisted of grooved 8 × 12-in. timbers. Starting at the top of the bulkhead, an 8 × 12-in. timber was installed between decks and bolted to the guide bars. The groove in the lower edge had a 2 × 4-in. spline fitted before installation. A second timber, similar to the first, was lowered and the timber pulled up so that the upper groove of the lower timber fitted over the spline in the lower groove of the upper timber. Similarly, each timber was placed in succession from the topworking down and ends bolted up. In order to facilitate the work, the timbers were weighted to overcome buoyancy. As they were fitted in place by the divers, workmen on the topside pulled them into place by hauling on slings attached to a saddle placed under the timber. After the timber was in place, the weights were removed, and the saddle unhinged, preparatory to placing another timber. Eventually, all the timbers of the bulkhead were in place with a tight fit between timbers but a nonwatertight fit where the ends butted against the decks. Also, there remained, necessarily, a gap between the lowest timber and the ship's side at the bottom.

The gap at the bottom was enclosed by wooden forms and sand bags. At the ends the timbers were enclosed by wooden forms placed at an angle of about 45 deg between the bulkhead to the nearest deck beam, giving the appearance of a continuous bracket. There was then a continuous gap enclosed by forms extending down one end of the bulkhead along a deck, continuing along the ship's side below, and then up along the original underside of the other deck. This space was filled with Tremie concrete working from the bottom up, resulting in a tight bulkhead. All openings in the compartment boundaries made up of the original ship's structure were ferreted out and closed by various types of patches and plugs. In connection with bulkheads, 15,000 linear ft of 8 × 12-in. timber were installed.

As the boundaries of any particular watertight compartment approached completion, a gang of divers proceeded with the installation of the necessary shoring. It was necessary to shore the promenade deck throughout, and it was also necessary to shore the intermediate decks which formed compartment boundaries. In comparison, the shoring of the promenade deck was simple in that it was necessary to shore only between promenade deck beams and the deck opposite. However, this, again, entailed the removal of all obstructions, in order that a good fit might be obtained. It was much more difficult in the case of the intermediate decks. Here it was found that the deck plating was so light that the panel between deck beams could not support the expected load. Therefore, it was necessary to strengthen the deck between frames. This was done by installing timber beams between the steel deck beams, running shoring between these timber beams, and placing similar beams or stringers on the opposite deck. A regular forest of shores was required in way of "C" deck. Roughly, six weeks after all the temporary bulkheads had been installed, shoring was completed, and toward the end practically all divers on the ship were used on this particular job. About 1000 shores were placed under water.

As the completion of shoring approached, the installation of platforms for the salvage pumps was undertaken. The pumps were installed on platforms which could be hinged so as to remain within 15 deg of the horizontal as the ship righted. Suctions were located with a view to their being able to drain from the lowest parts of the various pockets within the compartments. The discharges were led overboard horizontally through the promenade deck. In order to prevent the accumulation of exhaust gases in the ship, exhausts were piped overboard vertically through air ports on the starboard side of the ship. The pumps, all gasoline-driven, were installed in ample time to permit preliminary tightness tests of each compartment as it was completed. A total of forty 10-in. pumps, twenty-eight 6-in. pumps, and twenty-five 3-in. pumps, having a combined capacity of 40,000 tons per hr, were installed. It is well to note that work was scheduled so that the major items, that is, installation of bulkheads, completion of shoring, and installation of pumps, followed each other in rapid succession.

Just prior to the expected completion of the preliminary pumping tests, the north outboard corner of Pier 88, against which it appeared the vessel might foul as it righted, was removed and the original material in way of the pier dredged out.

RECENTLY EMERGED DAVIT JUST CUT FROM THE DECK OF THE U.S.S. LAFAYETTE IS LIFTED AWAY BY THE CRANE

(Notice to left the immense wooded patch over which water is rolling. Made of heavy timber as supports, to which planking was bolted, this patch made that section of the deck watertight.)

PUMPING OPERATIONS

Although the actual pumping of the ship comprised a definite, and the final stage, of the salvage effort, there was not a sharp division between the preparations for pumping and the commencement of final work of making the various compartments watertight, and the making of tightness tests of the various compartments merged into the final pumping operations.

As the construction work in each compartment was completed, the water was lowered inside the compartment to various levels up to 10 or 15 ft in order to determine the extent and location of leaks, and to correct them. In the *Lafayette*, an equivalent of fourteen separate ships had to be made tight. The volumes at 0.0 mean low water of the various fourteen compartments before pumping operations varied from as low as 260 tons to 17,600 tons.

Despite the fact that plans were studied in minute detail, and the emphasis placed on leakage prevention throughout the year or more of preparatory work, in almost every compartment the initial pump test resulted in long hours of search and plugging of leaks by divers. In some instances open ports, not shown on the ship's drawings, were found; in others, leakage through unblanked pipe lines and ventilating ducts had to be found and made tight. Most of the troublesome leakage developed through numerous scupper and plumbing drains. When a compartment had been tightened until one 10-in. pump, working at half speed, could hold a 10-ft head, it was considered satisfactory, although work was continued until the last minute to secure absolute tightness, if possible. Compartment testing progressed as the construction work in more and more compartments was completed. Attention was given throughout the tests to the amount of buoyancy gained in compartments from the pumping. During this phase there was never enough water removed from the ship to result in any change in physical position. Likewise, compartment testing and search for leaks were restricted to a certain extent by the allowable heads of water on the bulkheads of the compartment.

The compartment testing continued throughout the latter half of July, 1943, and by August 2, all preparations having been made, an over-all pump test was conducted. The water in the high or promenade deck compartments (Nos. 1, 12, 13, 14A, 16, 17, and 18) was lowered 1 ft, and in the lower or keel side of the compartments, 2 ft, so as to place a head on the pressure side of each patch. This test was maintained for about 48 hr, during which time divers applied sawdust to all patches, seams, etc., where minor leakage might exist. Sawdusting, along with the tightness gained from setting up the patches, resulted in the ship over-all being approximately bottletight. It was estimated that two 6-in. pumps could control all leakage during the rise of tide. The importance of securing as much preliminary tightness as possible cannot be overestimated, because of the great probability of leakage increasing during pumping due to increasing heads, working of the structures, and local failures to the point where they could not be controlled by the pumps.

At 4:30 a.m. on August 4, the water was lowered to 7 ft in the high compartments and to 8 ft in the low with reference to mean low water. At high tide, a small vertical movement of the bench mark on the bow was perceptible but this movement was attributed to change in trim or strain rather than rotation. It is well to note here that the entire pumping plan was designed to lighten the bow as much as possible to relieve the pressure that was believed to exist at the rock ledge in way of compartment 16.

Because there was no particular reason for speed and because it was extremely important to build up no forces or develop leakage which could not be controlled, pumping continued cautiously and each rising tide was utilized to supply the additional buoyancy necessary to move the ship. At 5:30 p.m., just prior to the rising tide on August 4, the water in the high and low compartments was lowered to —9 ft and —9$^1/_2$ ft, respectively, so that the 5-ft rise in tide would give a 14-ft and 14$^1/_2$-ft negative head inside. Air and water jets installed in various patches in the port side and along the port edge of the promenade deck were started and maintained continuously in order to relieve any mud suction which might exist. The midships movement-measuring devices indicated a horizontal movement of the promenade deck of a little less than 1 in. This movement in the right direction was a definite sign that the tendency for righting existed and all was well.

During the morning of August 5, water in the compartments was maintained at 14 ft as the tide fell. At low tide, the high compartments were pumped to —15 ft. Between 4:40 a.m. and 10:50 p.m. on August 5, compartments were pumped and flooded to hold the negative heads, mentioned. As tide fell and rose no appreciable movement was noted. During the day 15 wire-rope cable stays were rigged from the uncut portion of the superstructure buried in the mud to the above-water side of the promenade deck, to strengthen the superstructure which in

righting would have to plow through many feet of thick mud.

It was evident that additional buoyancy would be required before the vessel would commence righting and, consequently, greater heads would of necessity be imposed on the promenade deck. An inspection was made of the deck and shoring. As there was absolutely no evidence of undue loads on the exposed shores, or of leakage through seams and rivets, as might be expected from overloaded deck plating, it was decided to pump down, at 8:00 a.m. on August 6, to a head of about —16 ft and allow this head and buoyancy to increase with the rise in tide. It had been calculated that the moments of buoyancy and of gravity about the bilge keel would be approximately equal at that point. By 9:15 a.m. at about one-half tide, the vessel started to roll slowly and steadily.

At 12 noon, rotation (totaling about $1^1/_2$ deg) was stopped by flooding all compartments 2 ft, following the parting of some of the superstructure stays. Pumping was halted, while all hands turned to installing additional 1-in. cable stays with turnbuckles. Such action was necessary lest the inadequately supported cantilever load overstrain the connection of the superstructure in the promenade deck with the result that serious ruptures might occur.

The tying of the vessel's superstructure to the promenade deck was completed about 10:00 p.m. on August 6. The pumps were again started and the ship once more responded quickly. After 15 min of steady movement, amounting to about 4 deg, the compartments were again partially flooded to stop the ship's rotation in order to inspect the superstructure stays and relieve the strain on the superstructure incident to the rapid motion. At this point, one fact was definitely ascertained. There was no appreciable mud suction resisting the movement of the ship. This, of course, became apparent when it was observed that each time the water in the ship was lowered relative to the outside water level, the ship started to rotate and the instant pumping stopped the ship's movement stopped. It was felt that absolute control was held over its every movement.

During both tides on August 7, pumping continued slowly and the ship rotated to about 67 deg. On the morning of August 8, it was decided to move the ship from its 67 deg inclination to 45 deg by removing more than 11,000 tons of water chiefly from compartments 14, 15, and 16.

By the time the ship reached 49 deg inclination, pumping was stopped in order to shift a considerable number of pumps so that more favorable suction heads could be had. Early in the morning of August 9, pumps in compartment 16 were unable to lower the water beyond the existing level, and, by 8:00 a.m., the head in that compartment was reduced to an alarming degree, in spite of the operation of all pumps at full capacity. Shortly thereafter, as many as nine pumps could not maintain anything more than a 2-ft head in compartment 16. A leak of an extremely serious nature had developed in way of the rock ledge.

While efforts were being made to locate the leak it was decided to attempt to dewater the compartment by sheer pumping volume. During the night and early the next morning, activities were centered around shifting reserve pumps from other compartments into compartment 16, where by this time the inside water line was at the same level as the water outside the ship. It was considered unwise further to lower the water in other compartments appreciably because of the resultant great differential in head between adjacent compartments and compartment 16. However, such pumping as could be done, brought the ship over to about 42 deg by August 10.

It was still impossible to gain more than 1- or 2-ft head in the leaking compartment, with nine 10-in. pumps operating at full capacity. From the out-of-phase movement of the bow and stern, it was evident that the stern was afloat and the ship was pivoting about the rock ledge with the rise and fall of the tide. At this angle of inclination, most of the uncut portion of the superstructure, including boat davits, had emerged from the water, and, while divers searched for ruptures inside and outside of compartment 16, some 500 tons of the superstructure were removed. Early in the morning of August 11, the first of a series of ruptures in the double bottom and wing tanks forward of the first row of boilers in No. 2 fire room was found. Divers were unable to get down through the mud and rock to locate the rupture from the outside at this time. By the morning of August 14, it was felt that all of the ruptures in the tanks in compartment 16 had been located, and it was decided to attempt to fill most of the wing tanks, Nos. 3 and 4, double bottom tank No. 13, and the corner between the wing tanks and double bottoms, with some 100 cu yd of concrete. The concrete pour was to be made by the Tremie method and bounded forward by No. 4 watertight bulkhead and aft by a dyke which divers built of bags of cement. During this period the ship righted about 6 deg as a result of adding ballast in two starboard tanks and removing the remaining superstructure.

By the morning of August 17, the laying of the concrete had been completed. Twenty-four hours were allowed for the concrete to harden and pumping was once again resumed on the morning of August 18. At first, compartment 16 held tight but, suddenly, with a negative head of 10 ft, the water in compartment 16 commenced to rise rapidly with all pumps going, and within about $^1/_2$ hr the head was reduced to 5 ft. Subsequent inspection by the divers indicated that a rupture in the tanks had opened abaft the concrete dam previously laid. These new ruptures were found to be in way of the boilers; and, because the clearance between the boilers and the sides of the wing tanks was so small, divers could not actually reach them.

Following the failure on the morning of August 18, to dewater compartment 16, it was felt that if the vessel were righted to 20 to 25 deg, it would be safe to attempt flotation by pumping compartments adjacent to No. 16, as at that angle allowable heads would be acceptable. Consequently, on the afternoon of August 18, the first of 2800 tons had been placed in the wing tanks; by the morning of August 21, the full amount of 2800 tons was in. This resulted in the righting of the ship to about 25 deg. Additional water was then removed from compartments 14 and 3 and divers were busy scouring and using an air lift in the general vicinity of the hull damage. It was hoped that the new rotation would perhaps make the rupture in the hull accessible. Failing to get close enough to the rock pinnacle actually to locate the bottom damage, divers were instructed to place rags and sawdust bags near the outside ruptures with poles, or any other means possible, in hopes that some of them would be sucked into the rupture and partially choke off the leakage. Simultaneous explorations of the rock ledge finally revealed that the bearing was very jagged, so that further righting by counterflooding was abandoned.

Following considerable study and search, between August 22 and 30, it was decided again to attempt to stop the leaks by filling all of the double bottoms and wing tanks in way of any of the ruptures with concrete. This involved considerable preparation including burning and clearing out in the No. 2 fire room so that Tremie pipes could be fitted in place. Some 800 tons of concrete were poured into the tanks. This operation continued until the morning of September 10, after which 48 hr were allowed for setting. Not much faith was placed in the probability of reducing the leakage by the use of concrete alone; however, it was necessary to provide an obstruction of some sort, in the bottom, to prevent bags, mats, and so on, which would ultimately be necessary to stop the leak, from being sucked clear through the openings.

However, since it was necessary to float the ship clear of the rock in order to "feed" bags to the leaks, dependence had to be placed upon something other than the ability to pump out compartment 16. Inasmuch as only about 5000 tons had to be removed from adjacent compartments to float at high tide, the boundaries of compartment 16 were inspected and reinforced by shoring to permit entirely pumping out compartments 10 and

17, just forward of compartment 16, and gaining at least 5 ft more differential in head between compartments 16, 15, 14, etc.

Compartment 16 was given a trial test by pumping down and holding 3 ft. This test seemed fairly successful, so at 11:00 p.m. on September 12, pumping was once again attempted. By the morning of September 13, it was realized that the latest attempt at choking the leak by pouring concrete was only partially successful, and thirteen 10-in. pumps, delivering approximately 9000 tons per hr, were required to hold a 5- to 7-ft head in compartment 16. Pumping several thousand tons of water out of compartments 10, 15, and 16, at this time, however, had definitely brought the vessel afloat at high water on September 13. At the same time, a heavy strain was maintained on the bow mooring lines so that the ship was moved laterally about 16 ft. It was hoped that a considerable number of the rags and sawdust bags, which had been planted as close to the turn of the bilge as possible, would be sucked into the ruptures as a result of this movement. This operation was partially successful and resulted in the gaining of control of the leakage in compartment 16, so that about a 12-ft head could be maintained. The ship floated clear both at high and low tides by the morning of September 15.

Thereafter, pumping in all compartments was prosecuted as rapidly as possible. However, it was extremely slow as access for shifting pumps as they lost suction became very difficult, it being necessary to cut access openings through doors, bulkheads, etc., to move the pumps and run suction to the numerous low pockets. In so far as compartment 16 was concerned, since the bottom was well clear of the rock ledge, it was just a matter of time and labor for divers to choke off the leakage until it could be controlled and pumped all the way down with one 10-in. pump in each of the two fire rooms comprising that compartment. Some 2000 to 3000 bags of rags were ultimately fed into the ruptured hull to fill the voids between the plating and the concrete before the leakage was reduced to a negligible amount.

Because of the large off-center weights and the flooded condition of the ship, it floated in equilibrium at about 26 deg. From September 16, work was directed toward removing the tremendous amount of timber and concrete construction from the port side of the ship, cleaning out cork and oil, ballasting the starboard wing and bottom tanks, removing the remaining water and large quantities of mud and debris from the ship, preparatory to turning it over to the Commandant of the Third Naval District for rebuilding. This was done on Navy Day, October 27.

CONCLUSIONS

On the whole the entire salvage operation, from the initial development of the plan, through the preparations, and to the final floating and cleaning of the ship, was considered extremely successful. Except for the failure and consequent leakage in compartment 16, where at the start there was no indication of leakage and where bearing on the rock precluded inspection, absolutely no leaks developed, nor were there any signs of failure in any of the construction work, practically all of which was done under water and not susceptible of thorough inspection. Examination after dewatering revealed workmanship of as high a quality as is usually encountered in work done in the dry. As a result, there was little anxiety on the part of those in charge during the long period required to "conquer" compartment 16, because the leakage into the remainder of the ship was so small as to require very little attention, and it was a simple matter to hold any gains made. Credit is primarily due to Captain Tooker, the supervisors, the divers, and other workmen who were responsible for devising means for, and the actual accomplishment of, the many details of the construction and other preparatory work, upon which the success of the plan depended.

CAPT. J. I. TOOKER, AT LEFT, LOOKS ON AS CAPTAIN MANSEAU GIVES THE LAFAYETTE INTO THE CHARGE OF CAPT. H. V. MCKITTRICK, U.S.N.

THE PHILOSOPHY *of* AVIATION

By RALPH S. DAMON

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AS EACH day passes and the United Nations' course to victory becomes more clearly defined, it is more and more apparent that air power is the predominant weapon we have to use whether used alone or in combination with our other forces. History will show that air power was always the determining force in this war.

The factors establishing aviation as our most potent weapon are almost elementary. We have been able through American ingenuity, initiative, and production genius, to which management and labor have contributed alike, to roll more than 8300 planes in one month out of the doors of our aircraft plants. This is at a rate greater than 100,000 planes a year and that figure is still on the increase. And what is even more important, we are building planes superior in quality to those being produced by our enemies, as shown by the battle records of our various air forces. Another extremely important factor in air power's drive for victory is the composition of the United States Air Forces. These forces headed by General Arnold and Admiral King, ably staffed and guided by outstanding air-force leaders, within another year will exceed the combined strength of all other air forces in the world.

LUFTWAFFE ECLIPSED

Germany had spent years building the Luftwaffe into the most powerful air force the world was to know until about sixteen months ago, but the air forces of the United Nations sent the Luftwaffe into an eclipse from which it cannot emerge in this war. We have established too many odds for them to overcome. We are fighting them with superior-type airplanes and that superiority becomes greater as each new American-type airplane flies against the enemy. General Arnold is not operating with any haphazard air force hastily thrown together for combat purposes. He fights with an air force built along deliberate lines to attain its objective—victory. His flyers undergo an intensive training which, coupled with their inherent and demonstrated bravery, makes them the greatest body of trained flying men in the world today. These young men will always deserve the gratitude of a nation thankful for victory and for peace. In other words, the success of our air forces can be attributed to courageous flyers well trained and well led, using excellent planes.

The supply lines of the air forces have been kept constant by the job being done night and day, day in and day out by the Army Air Transport Command and the Naval Air Transport Service. While we sit here tonight, the planes of these commands are flying into and over the continents of the world carrying supplies, food, equipment, medicines, and munitions, evacuating the sick and the wounded, and hurrying staff generals to important strategy meetings. The war is being materially shortened by this work. In this work the services are receiving great assistance from the commercial air lines of our country, many of whom under contract are flying to the remote corners of the world in the war service of our nation. In addition, most of the air lines have been glad to make available to these services many of their executives and key personnel whose experience and capabilities have meant so much to the successful operation of the transport commands.

In any discussion of aviation, it is necessary to review briefly its history. This is desirable because aviation is unique in that it is one of the few industries in the American scheme of things to grow to such prominence in a relatively short space of time. It was forty years ago, on Dec. 17, 1903, that the Wright brothers flew their airplane for the first time and then for a distance of less than 1000 feet. Ten years later airplanes were setting speed records of 126 miles an hour and one had flown 933 miles in continuous flight; and another had flown to an altitude record of 19,000 feet. These planes were especially typed and their utility was strictly limited to the purpose for which they were designed.

Aviation at that time was still in the field of hobbies. How limited the hobby was can be gained from this fact—in 1914 there were in the United States 16 companies founded principally on imagination and hope. In that year 145 planes were manufactured—less than an average of ten per company. In that same year our Army had six planes and our Navy eleven.

Three years later in 1917, when we entered World War I, the Army had 55 and the Navy 54. In 1917 American "know-how" and production genius were called into action, with the result that when the Armistice came in 1918 the Army had 8396 planes and the Navy 2107. Of the Army Air Force, less than 700 planes had gotten even close to a war theater. Compare this with the fact that today the aircraft-manufacturing industry, measured in dollar value of output, is more than five times as great as the automobile industry ever was in its largest year of normal production.

Following World War I, with aircraft manufacturing facilities capable of producing 21,000 planes annually, aviation was allowed to succumb to a fine case of doldrums and bankruptcies, and nobody paid any attention to it until 1926 when there was established by Congress a five-year plan for providing our military forces with airplanes. In that same year the Aeronautic Branch of the Department of Commerce was created and the Post Office began to award contracts to fly the mail. 1926 was the year that aviation became transportation. Since that time aviation, like other forms of transportation, has not been static. This rapidity of growth stimulated by constant research always for speed and safety has created what is proving to be the ace card of military strategy. In spite of all the highly dramatic motion pictures produced in the 20's and the 30's the airplane was still a secondary weapon in World War I. I doubt if its use had any important bearing on the outcome of any major battle in that war. Aviation's power was potential but not demonstrated. Only the visionaries could appreciate it. After World War I we developed the airplane as a vehicle useful to the peacetime economic and social life of the community and then when war again broke out, its utility as the most potent weapon we have is now discovered and demonstrated.

WAR DEVELOPMENTS TO HELP POSTWAR MANUFACTURE

Fortunately, at the conclusion of this war we will have learned many things about speed, altitude, and practical aerodynamics from the high-speed fighters and the heavy bombers our manufacturers have developed. Practically all of those developments can be applied to the manufacture and operation of the planes we will be using in our air-transport system a few years hence. If the development of our aircraft progresses with no impetus other than received from this war, it is safe to assume that 25 years from now St. Louis will be no further from Europe in respect to time than Poland was from Berlin in 1939.

We have unknowingly and certainly unintentionally developed wartime aviation into a Frankenstein. We have in

An address delivered at the Annual Meeting, New York, N. Y., Nov. 29–Dec. 3, 1943, of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

aviation an instrument which in wartime is the most devastating weapon of modern combat but which in times of peace can be of tremendous value to stimulating commerce and international good will. In order to tame the Frankenstein characteristics, we must give serious thought as to the aviation future. The great utility of air transport and aviation's benevolence is limited unless the plans for that future are based upon some form of practical international collaboration. As long as the airplane continues to develop in speed and range, the false security of isolationism continues to shrink.

POSTWAR AVIATION AND INTERNATIONAL RELATIONS

If we are to capitalize beneficially for mankind on aviation and if the potential expansion as we visualize it now is to become a reality, then it is necessary for many of us to change our thinking in regard to a world-wide basis. The recent Moscow conference at which the foundation of international collaboration was started could well be broadened to include postwar aviation. Unless that foundation is developed now, we have done little to prevent the formation of a compartmentized or Balkanized world in the peace.

Specifically, aviation is a distance annihilator. Secretary Hull flies to Moscow from Washington in less time than an earthbound passenger can reach Los Angeles from the same starting point and Secretary Hull has covered a much greater distance. Mr. Churchill comes to Washington from London in less time than our earthbound passenger takes to reach Chicago from New York. The Hull and Churchill flights are in no way exceptional today. They are made under wartime conditions and all economic factors are removed. In the peace the same flights can be made by you and by me, but then cost will be one of the prime considerations.

Air transportation like any other form of transport must be a mass movement to be successful and economical. Its basis is traffic, and traffic depends largely upon population. How extensive was the air-transport system serving this country in 1941 can be shown by a few figures. In that year the domestic air lines flew routes of 44,433 miles and provided direct air transportation to 270 cities. There were only three cities of more than 100,000 population farther than 25 miles from an established air-line stop. Similarly, there were only 11 cities between 50,000 and 100,000 population, and just 51 cities between 25,000 and 50,000 which were more than 25 miles from a regular air line.

A large percentage of those communities will be provided with air service following the war. The Civil Aeronautics Board has received applications covering many of them and when additional airport facilities are constructed service will undoubtedly be available. By service I do not refer to "feeder type" service because that is a misnomer since I believe there is no such thing. When those communities receive air service it may be local service of existing lines or new service connecting with existing lines. "Feeder-type" service is a misnomer because it indicates that it is a substandard service. In the air lines we cannot have substandard service, particularly in matters of safety.

This local service interconnected with existing air-line service is nothing novel to the air lines since they have for years operated schedules into relatively small communities situated between the larger metropolitan areas. Sometimes such stops are by no means self-supporting, but the contribution of traffic they offer to the entire air-line system warrants them. An air-line operating into a smaller community is merely a natural expansion of routes. If more and more localities are to benefit from air service, they can obtain this service by the construction of airports, and where small communities are closely grouped together geographically, they can justify much more frequent stops by pooling the stops at one centrally located airport. An outstanding example is the Tri-City airport which serves Bristol, Va., and Johnson City, Kingsport, and Bristol, Tenn.

We may assume that there exists and can be developed sufficient traffic in the 65 cities of 25,000 population or more which were more than 25 miles from an airport so the construction of adequate airports would appear to be one of the problems the authorities in those communities should immediately consider. For, if they are to enjoy the advantages of air service, they must provide themselves with satisfactory airports implemented with radio facilities.

There exists today the possibility of evolving a new economic and population pattern in many states through the air fields constructed during this war for military purposes. The majority of these fields are not near large population centers, but it is not too imaginative to conjure a picture of a few years in the future when communities may have sprung up around many of these now isolated fields simply through the development of air-transport service. In the development of our country, population centers in the past have always been determined by transportation facilities. At one time all of the towns were close to water—the ocean, lakes, or rivers. The coming of the railroad permitted the development of additional population centers not on bodies of water. Towns and villages were founded in what had been remote and otherwise inaccessible parts of the country and they were founded in many instances at railroad junctions. Similarly, it is not too fantastic to presume that these military airports in remote parts of the country can serve as a nucleus of a pattern of air-line junctions and that prosperous cities will eventually spring up close to them, thus reversing one of our problems.

FORESEES U. S. POPULATION OF 153,000,000

The population growth of our country has probably exceeded that of any other nation in the world. A little more than 100 years ago our population was 9,500,000; 65 years ago we had a population of only 40,000,000, and that figure has now been tripled to the present figure of 134,000,000. It is predicted that in 35 years, without considering any immigration, our population will reach 153,000,000 and perhaps much of this population increase may center around these presently isolated airports.

Aviation's contribution to our civilization will continue to the fullest extent provided constructive and sympathetic public and governmental consideration is given now to the future of air transportation. But unless this consideration is given soon by our government in collaboration with the other United Nations, the inaction may prove detrimental to what we hope to establish as the air future.

My plea for international collaboration on air transport's future is based on a desire to prohibit a repetition of past mistakes when air-transport monopolies were allowed to grow on a nationalized basis. It is of the highest importance to the air-transport industry and in turn to our country that we do not permit our future air policy to be tinged with distrust or fear of nationalized foreign competition. This distrust and fear can be eliminated now if there is international collaboration. This collaboration must be instituted promptly and not later when many of the nations might be reluctant to discard any plans they have formulated independently.

And by collaboration I mean true international collaboration and co-operation worked to the greatest possible extent for the benefit of our world. The basis for such collaboration is provided for in the resolution drafted by Senator Joseph H. Ball of Minnesota with Senators Burton, Hatch, and Hill, and introduced into the Senate March 16, 1943. This is the famous resolution which called for a realistic approach to the maintenance of a lasting peace through the concerted action of many nations, and undoubtedly the contents did much to inspire the recent talks our Administration has had with the British, Russians, and Chinese.

In describing the mechanics of the resolution Senator Ball recently said:

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The ENGINEER *and the* AMERICAN PATENT SYSTEM

By A. A. POTTER

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INTEREST OF THE ENGINEER IN A SOUND PATENT SYSTEM

EVERY person interested in the prosperity of American industry wants a sound patent system, for he realizes that public welfare requires adequate protection for new ideas as an incentive for the inventor to create new machines and processes, and as an inducement for the investor to finance the conversion of the invention into a marketable product.

A clear understanding is essential of the difference between an invention, a patent, and a marketable product. Invention is the act of finding something that is new. A patent is a grant of exclusive right to the inventor to his invention for a limited period of time. An invention is not a product, and the patent by itself does not produce a product. To produce a marketable product a new idea in the form of an invention must be developed and embodied in a form suitable for manufacture, and appropriate tools must be available so that the product can be manufactured at a cost acceptable to the public. The patent serves to protect the inventor and those who develop, manufacture, and sell the product from the uncontrolled competition of parties who have not shared the burden of invention and its commercialization.

The vision of the founders of this nation is evidenced by the fact that the American patent system was established by the Constitution, giving Congress the "power to promote progress of science and useful arts." Our patent system is more than 150 years old, or as old as this nation. It gives to the inventor certain exclusive rights for a limited period of time in return for the full disclosure by him to the public of his invention. The inventor could not afford to bring out a new product unless he had the legal right to keep others from copying it, at least for a limited period of time. If he did produce his invention without patent protection, he would most likely keep his process secret and his knowledge would die with him, thus retarding science and industry to the detriment of the public. This disclosure, through the patent, stimulates others in creative endeavor, thus enhancing the widespread sharing of the benefits of invention.

The American patent system, which is intended to create new business enterprises based upon invention without reliance upon secret processes, has, in a brief period of 153 years, been a major factor in changing a small struggling nation into the most powerful industrial people in the entire world and in raising our people from bare subsistence to a point where we enjoy the highest standard of living known in history. Americans have not only greatly benefited from the more than two and a quarter millions of inventions for which patents have been granted since the beginning of our patent system, but they have been trained to invent. It is most significant that the major epoch-making inventions of the past 150 years, which include among many others the telegraph, the telephone, the electric light, the reaper, the typewriter, the adding machine, the trolley car, the air brake, the sleeping car, the power elevator, the sewing machine, the phonograph, and the airplane, were made by American men of genius. Many of the comforts and conveniences people enjoy would never have been developed without the protection of our patent system, which has facilitated the rapid commercialization of new discoveries to an extent exceeding that of any other country. Has the American public paid too great a price for yielding to the inventor the exclusive right to his creation for a period of only 17 years? Michael Pupin, in his book, "From Immigrant to Inventor," stated, "Every good invention benefits the public immeasurably more than it benefits the inventor or the company which exploits the invention." The electric-communications industry, including the telegraph, the telephone, and the radio, is an example of an industry built upon patents. On the other hand, lack of patent protection has been an important factor in the slow progress of low-cost housing. The demand for patented products has greatly extended gainful employment in this country.

The American patent system has not only accomplished what the framers of our Constitution intended it to do, but has served as a model for the patent systems of all industrial nations. However, as with any system of long standing, conditions arise which were not foreseen at the time of its establishment. The public interest will be served most effectively by constructive modifications in our patent system to meet the changing conditions, while encouraging the inventor to create and the investor to commercialize new devices and processes for the benefit of humanity.

Several different groups have appraised our patent system during the past 30 years, and on Dec. 12, 1941, the National Patent Planning Commission was created by the President of the United States, through Executive Order No. 8977, for the purpose of readjusting our patent system to the changing conditions and to advise "to what extent the Government should go in stimulating inventive effort in normal times; and what methods and plans might be developed to promote invention and discoveries which will increase commerce, provide employment, and fully utilize expanded defense industrial facilities during normal times."

The Commission, in the introduction of its first report to the President, made the following statement:

> The American people and their government should recognize the fundamental rightness and fairness of protecting the creations of its inventors by the patent grant. The basic principles of the present system should be preserved. The system has contributed to the growth and greatness of our nation; it has:
>
> (1) Encouraged and rewarded inventiveness and creativeness, producing new products and processes which have placed the United States far ahead of other countries in the field of scientific and technological endeavor
>
> (2) Stimulated American inventors to originate a major portion of the important industrial and basic inventions of the past 150 years
>
> (3) Facilitated the rapid development and general application of new discoveries in the United States to an extent exceeding that of any other country
>
> (4) Contributed to the achievement of the highest standard of living that any nation has ever enjoyed

Presented at a meeting, Louisville, Ky., Oct. 14, 1943, of the Louisville Section of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS and the American Chemical Society.

(5) Stimulated creation and development of products and processes necessary to arm the nation and to wage successful war
(6) Contributed to the improvement of the public health and the public safety; and
(7) Operated to protect the individual and small business concerns during the formative period of a new enterprise.

The strongest industrial nations have the most effective patent systems, and after a careful study, the Commission has reached the conclusion that the American system is the best in the world.

The types of problems considered by the Commission should prove of interest to engineers.

PATENTS AND THE WAR

It has been charged that patents have been used to hinder the war effort. Specific inquiries addressed particularly to the representatives of the armed forces failed to develop any serious instances in which the patent system has interfered greatly with the prosecution of the present war. Never before has there been such a free exchange of scientific and technological knowledge and products of inventive genius between our industries and our own government, and between our government and our allies. Such a liberal and complete exchange of scientific information and the secrets of industrial and educational laboratories could not have been possible without the reassurance of protection by our patent system. Present legislation is adequate to serve the government's wartime needs. Existing laws permit our government and its contractors and subcontractors to manufacture and to use any invention, regardless of the citizenship of the owner, upon the payment of reasonable compensation. These laws operate both in peace and in war. Dr. Robert A. Millikan stated, "When the full story of this war is told, count upon it that patent protection will be one of the heroes upon which a Congressional medal will be conferred by a grateful American public."

PROTECTION OF PUBLIC INTEREST

Charges have been made that patents have worked against the public interest in the following ways:

Suppressed Patents. There is a rather general misconception that nonuse is necessarily the suppression of a patent. Nonuse of a patent, which is not commercially usable, does not involve the willful withholding of its uses. Industrial organizations frequently control patents on more than one way to do a job. This is inevitable, as one seeking to perfect a new device or process will uncover several ways of accomplishing his objective of which one almost always proves the best under changed conditions; failure to use the alternatives is not suppression.

Nonuse of patents may usually be traced to technical or economic reasons because of which the patents are incapable of commercialization or are at a disadvantage competitively. Unused patents are found most generally in rapidly developing industries where technical progress is great and where obsolescence is an important factor.

It is conceded that about one half of the patents of certain large and progressive concerns are not being "worked." It must be realized, however, that in order for a patented invention to be put to use, there must be acceptance by the public of the subject of the invention. If, for any reason at all, the public does not desire the particular improvement, or if there are difficulties of marketing which render it noncommercial, resultant nonworking of the patent is to be expected. In other instances a patented invention may not be used because the organization which produced the idea is not in a position to exploit it. Then market conditions may be averse or customer resistance may entail excessive costs for merchandising the invention. In some cases patents are shelved for several years after they have been issued pending financial, commercial, or technical development. Some patents must await new markets to justify their commercialization. Even if a patent is technically sound, it must have financial backing for its development and a market for its sale.

A careful analysis of the foregoing factors which justify nonuse of patents and of the various charges of suppression which have been given general publicity indicates that American industry has not been guilty of suppression of patents to any significant degree. A patent for which there is a substantial public demand will not long be kept from the market. Dr. F. B. Jewett said: "Personally, during an experience in industry of nearly forty years, I have never known of a single authenticated case where a valuable invention was willfully suppressed." On the same subject Thomas A. Edison stated as far back as 1912: "I have heard and read numerous statements that many corporations buy valuable inventions and suppress them, but no one cites specific cases. I myself do not know of a single case. Before any changes in the law are made, let the objectors cite instances where injustice has been worked on the public by the alleged suppression of patents."

An independent examination of the various charges of suppression has revealed no evidence which would modify the conclusions reached by Mr. Edison more than thirty years ago.

Compulsory Licensing. A careful study of compulsory licensing in other countries leads one to conclude that any general system of compulsory licensing is undesirable for the United States from the standpoint of public good, as such a compulsion would unduly impair the value and effectiveness of the American patent system.

The tendency to compare conditions in this country in respect to compulsory licensing with those prevailing in foreign countries has been misleading, as there are governmental and economic conditions in countries where compulsory licensing laws are in effect which are fundamentally different from the conditions in the United States. Back of the philosophy of compulsory licensing in other lands was the limited industrial development of those countries and the objective of such compulsion was to force the manufacture of articles within the boundaries of these lands.

Certain foreign countries have instituted compulsory licensing systems to force the growth of industries in their lands, without regard as to whether or not the stage of development, or the market, or the resources of the country are able to support new manufacturing enterprises, but compulsory licensing has not been successful even in foreign countries because the establishment of private enterprises can be induced or encouraged, but it can seldom be effectively forced or compelled. The result of compulsory licensing in other lands was that the patent was allowed to lapse or be canceled, often to the disadvantage of the public. While compulsory licensing is intended as an inducement to prospective licensees, it added little to industry's total wealth, in that incentive was taken away from the owner who is the patentee.

The principle of compulsory licensing may have some justification as a measure of self-defense in countries of limited natural and human resources, or in those which have a major portion of their industries under foreign control, or in lands which have a considerable portion of their patents granted to foreigners. The following facts with reference to patents in this country are pertinent in comparison:

(*a*) The United States grants during normal times more patents per year than any other two of the most industrialized countries of the world.

(*b*) Nearly seven eighths of the total patents granted in this country are granted to Americans. More than one fourth of German patents and more than one half of the British or French patents, nearly two thirds of the Italian patents, and over nine tenths of the Canadian patents are granted to foreigners.

(*c*) Nearly one half of all American patents are granted to individual inventors, more than one third to small industries, and less than one fifth to large industries.

(*d*) A general system of compulsory licensing would prove most detrimental to the individual inventor and to the small industry, as the large corporation would, through compulsory licensing, be in a position to deprive those less financially able to enjoy the benefits from their inventions.

(*e*) Compulsory licensing may be necessary in countries which have their industries largely under foreign control. This is not the case in this country.

(*f*) In the United States we have the most creative people in the entire world as well as great natural resources, wide markets, and a widely developed industrial system. Americans still prefer to create and develop their own industries upon their own initiative and to pay the cost needed to do so. If Americans need an invention made in a foreign land, our industries are willing to pay the necessary cost of acquiring rights legally. Furthermore, the rapid growth of our research laboratories requires a type of patent protection which would be denied if a broad compulsory system were adopted.

While a broad compulsory licensing system is undesirable for this country, a degree of compulsion may be necessary or desirable in connection with patents which affect national defense, public health, and public safety. Our laws in this regard appear satisfactory, but should be clarified so that there is no possible difficulty in making available to the public all patents which would promote national defense or are in the interest of public health and public safety.

Harmful Business Monopolies. Charges have been made that patents are being used to create monopolies which are detrimental to the public. The late Dean John H. Wigmore has said recently, "Neither courts nor treatise writers have been radical enough in defending the legitimacy of the monopoly in a patent, as distinguished from the ordinary trade monopoly . . . . Any monopoly may be abused. What is wrong is not the monopoly, but the abuse of it." The antitrust laws are intended to prevent injury to the public which may result from monopoly and apply to patents as well as to other types of property. Thus the patent owner may fix the price of the sales of his own product, but he cannot lawfully combine or agree with others to maintain similar prices. After he has sold his product or has licensed operations under his patent, his rights are similarly held to have been exhausted. Judicial decisions have definitely curbed trade practices which go beyond the reasonable exercise of the rights under the patent grant.

Patents have been used in transactions which are open to question under our antitrust laws. An examination of the relation between patents and antitrust laws, and the various proposals affecting the former which have from time to time been advanced in connection with implementing the latter, will reveal that there are good license restrictions and patent pools and cross-licensing which are definitely in the interest of the public. Again there are bad restrictions and patent pools and cross-licensing and other agreements which should be unlawful. It may also be true that in line with recent developments with respect to patent pools, cross-licensing, and international agreements, commonly referred to as cartels, the importance of the antitrust cases which involve patents may have become relatively greater in recent years than heretofore. A digest of 428 cases from the records of the Department of Justice, under the antitrust laws, for the period of 52 years from Oct. 13, 1890, to Oct. 8, 1942, reveals only about 35 cases in which patents may have played some part or in which the alleged abuses arose or might have arisen in whole or in part out of transactions involving patents.

Patent pools, cross-licensing agreements, and questionable block-licensing in restraint of trade do exist, but such undesirable practices are a violation of the anti trust laws and are not exempted from drastic action by the courts. Yet, patents are not the major cause of unfair competition and restraint of trade. Actually, the patent cases have represented less than ten per cent of all antitrust cases.

Limitations of Licensing and Recording. It has been charged that by inserting restrictive limitations in licenses patent owners are able to exert control over competition to the injury of the public. There is no reason, however, for outlawing all restricted patent-license agreements, since many of these have already been outlawed by courts, and the orderly process of judicial procedure is certainly adequate in this country to draw the line between what is lawful, and what is unlawful; to outlaw blindly the good with the bad will do far more harm than good. Many forms of the commonly used restrictions serve a highly useful purpose and directly contribute to industrial progress. Thus it may prove highly desirable if a small business operated in one section of our great country has the right to grant a license for similar operation in another part of our country. Similarly, a holder of a patent operating in one given industry should be free to license his patent for further development and use it in a different and noncompetitive field.

The chief beneficiary of our patent system should be the American public. This is true whether a patented invention is commercialized or not. In the former case, the public has for its use and at its disposal a new product or process; in the latter it has made available recorded knowledge, which prior to the effort of the inventor, was unknown to the world. Despite these benefits to the general public from the operation of the patent system it is nevertheless true that patents may be and have been abused. The abuse arises not from the patent itself but by virture of secret, improper, and even illegal agreements. The exposure of agreements dealing with patents should minimize these abuses and, in any event, make them readily detectable. The Commission accordingly feels that there should be a compulsory requirement for the recording of the agreements so that they will be available to the public, to governmental agencies, and to Congressional committees.

The Commission therefore recommends the passage of legislation compelling the recording in the United States Patent Office of

(1) All existing agreements to which one of the parties is a citizen of a country foreign to the United States
(2) All existing agreements regardless of citizenship of the parties which include any restrictions as to price, quantity of production, geographical areas, or fields of use
(3) All future agreements regardless of restrictions or citizenship of the parties.

Revocation of Patent Grant. It is generally conceded that the United States Patent Office has a more thorough and highly developed procedure for the examination of applications for patent than any other country. However, in spite of the efficiency of its classification system and examining technique it is obvious that the examiners are not and cannot be informed as to all existing facts having a bearing upon the novelty or prior use of the thousands of inventions deposited in the office each year. It follows that a patent may be and frequently is granted which would have been refused if the Patent Office had been in possession of additional facts. No opportunity is afforded the public for submitting evidence to the Patent Office or supplying pertinent facts as to novelty and use prior to the issuance of a patent. An issued patent is invalid if the patentee was not the first and original inventor or if the invention was published or publicly used for a certain period before the application was filed. Yet although a patent may be invalid or of questionable validity for any of the foregoing reasons, it may be used by the

owner as an instrument in restraint of trade, or to force tribute from unwilling licensees, or be used in various other known ways to accomplish many of the purposes that would be legitimate only under a valid patent. Even the Patent Office itself is powerless to withdraw or to cancel an issued patent however inadvertently granted. This unhealthy situation constitutes one of the serious weaknesses in the present system.

There should be some provision whereby information and facts bearing upon the validity of a patent can be brought to the Patent Office, thereby giving it an opportunity to reexamine its decision to grant a patent and also to afford the public a full opportunity to challenge the validity and to bring about a revocation of an improperly granted patent.

The foregoing facts led the Commission to conclude that it is in the public interest that the granting of the patent should not become final, in so far as the Patent Office is concerned, until the expiration of some limited period such as six months. During this period provision should be made for a challenge or cancellation proceedings which could be initiated on any grounds by any party having more than a frivolous interest and could be joined in by other interested parties. If such opposition is successful, the patent would be canceled by the Commissioner of Patents. The free services of an officer in the nature of a public defender should then be made available to the patentee.

The Commission recommends that opportunity be accorded any member of the public to challenge the validity of any patent in a proceeding begun within six months after its grant. The enabling legislation should specify that the failure to challenge within the period indicated shall not prejudice the rights of any person in a subsequent infringement suit. Cancellation proceedings should be initiated in the Patent Office with an appeal by either party to the Court of Customs and Patent Appeals. The services of an officer in the nature of a public defender should be made available to the patentee.

PUBLIC REGISTER OF PATENTS

The feature of the British patent law commonly known as "licenses of right" seems to be a desirable innovation in our own patent system. "Licenses of right" provide the means whereby a patent owner can publicly proclaim his willingness to grant licenses under his patent on either reasonable or stated terms. In this country this could be accomplished by providing a public register in the Patent Office on which patents would be entered on the request of their owners with a statement of terms, if any, on which a license could be granted. Such a register could be brought to the attention of the prospective licensees through the official *Gazette* of the Patent Office or through another suitable publication. It is believed that this system would prove beneficial to many individual inventors who find it difficult to approach and interest manufacturers in the exploitation of their inventions. Owners of large aggregations of patents may also find it profitable to place their patents in the official register. The recording of patents on the register should be at government expense and without cost to the patentee.

The Commission therefore recommends establishment in the Patent Office of a public register upon which would be placed those patents under which the owner would be willing to grant licenses on stated or reasonable terms. When an interested party and the owner are unable to agree as to the unstated terms for a license under a patent entered on the register the Commissioner of Patents shall fix the terms after an opportunity for hearing with right of appeal to the Court of Customs and Patent Appeals.

UNIFORM STANDARD OF INVENTION

There is considerable concern on the part of certain groups that the examination given by the Patent Office examiners before issuing a patent is inadequate to insure a high standard of patentability. One reason for this is the lack of a uniform test or standard for determining whether the contribution reported by the inventor merits the award of the patent grant. There is often wide divergence between the standard of patentability used by the Patent Office and that used by the courts.

Recent decisions of the Supreme Court have led some circuit courts to rule that a patent should not have been granted if the invention is the result of "the slow but inevitable progress of an industry through trial and error." The fear has been widely expressed that this attitude of the courts with reference to the standard of patentability will operate to curtail invention through research and development. The opinion announced by the Supreme Court on Nov. 10, 1941, in connection with the Cuno Engineering Corporation case, 314 U. S. 84, 91, i.e., "That is to say the new device, however useful it may be, must reveal the flash of certain genius not merely the skill of a calling" is most unfortunate in its effect upon the courts and industry. The "flash of genius" theory is unsound and entirely too restrictive. The foregoing phrase was probably merely an incidental and passing remark and did not rise to the dignity of the announcement of a new or changed rule of law.

Unfortunately, the publicity given to the "flash of genius" phrase is influencing the courts in a manner which is detrimental to the granting of patents for important improvements and for new devices and processes which are the result of exhaustive research, experimentation, and development. This is particularly unfortunate, as research as a source of invention is becoming more and more important, and in highly competitive industries research is an absolute necessity. It must be realized that recent years have brought about marked changes in the process which brings about invention. Organized group research has developed rapidly to a point where it has become a major factor in inventive and industrial advance. Industrial, educational, and governmental research laboratories, whose operations range from simple product and process engineering to long-range delving into the unknown realms of science and technology, have grown rapidly all over the country. In 1940 a survey, under responsible auspices, indicated that industrial laboratories alone numbered more than 2000 and were employing more than 70,000 persons on a combined annual research budget of almost 300 million dollars. The function of the patent system in providing protection and security for the tremendous investment essential to these various kinds of research activities has come to equal, if not actually outstrip, in importance its original function of holding out a reward as an inducement to invention and research. No single factor will contribute more to the fullest utilization of our country's expanded defense facilities in the postwar period than the encouragement and maintenance of the research facilities of our country.

While those interested in industrial progress are in favor of enhancing the quality of inventions for which patents are granted, they are convinced that many improvements in existing devices and many new devices and processes, which are based on painstaking research, are fully as worthy of patents as are those inventions which are considered "flashes of genius." Flashes of genius cannot alone be depended upon to develop new devices in the field of electronics or to benefit the public through the development of new and useful synthetic materials and complicated chemical processes which deserve patent protection to advance science, industry, and commerce.

On the subject of standard of invention the National Patent Planning Commission has come to the following conclusions:

DECLARATION OF NATIONAL POLICY

The most serious weakness in the present patent system is the lack of a uniform test or standard for determining whether the particular contribution of an inventor merits the award of the patent grant. The patent statute itself is quite specific. R. S. 4886 provides that a patent may be obtained by "any person

who has invented or discovered any new and useful art, machine, manufacture, or composition of matter, or any new and useful improvements thereof . . . . . upon payment of the fees required by law and other due proceedings had." The difficulty in applying this statute arises out of the presence of the words "invented" and "discovered." Novelty alone is not sufficient, nor is utility, nor is the final accomplishment. There must also be present some mysterious ingredient connoted in the term "invented."

Many different and unrelated tribunals now are forced to make their individual decisions, among them being the Patent Office, the several district courts, the various courts of appeals, and the Supreme Court. The difficulty is that there is no accepted uniform standard among these several tribunals which can be applied in the same or similar cases. There is an ever-widening gulf between the decisions of the Patent Office in granting patents and decisions of the courts who pass upon their validity. It would be highly desirable and a great step forward if patents could be issued with a greater assurance that their validity would be upheld by the courts. No other feature of our law is more destructive to the purpose of the patent system than this existing uncertainty as to the validity of a patent. The admonition is frequently heard that there should be "fewer and better patents," an impossible accomplishment so long as the present divergence of standards between the Patent Office and the courts and the several courts themselves obtains. Whether the standard of the Patent Office is too low or that of the courts is too high is not for us to determine. There should be a uniformity in the grant and treatment of patents. The present confusion threatens the usefulness of the whole patent system and calls for an immediate as well as an effective remedy.

It is inconsistent with sound national policy to continue to grant patents with existing uncertainty as to their validity, and unfair to the inventors of this country and to manufacturers and investors who have proceeded on the basis of a protective security in the form of a patent issued to them by the federal government. The Commission feels that not one but several steps should be taken to remedy the present situation. A promising improvement would be for Congress, by legislative enactment, to lay down a reasonable, understandable test by which inventions shall be judged both from the standpoint of the grant of the patent and the validity of the patent thereafter.

The Commission therefore recommends the enactment of a declaration of policy that patentability shall be determined objectively by the nature of the contribution to the advancement of the art, and not subjectively by the nature of the process by which the invention may have been accomplished.

VALIDITY QUESTIONS SHOULD HAVE THE ADVICE OF THE PATENT OFFICE

The power to grant patents for inventions is vested by our Constitution in Congress and not in the executive or the judicial branches of our government. Congress has delegated the power of granting patents to the Patent Office which makes the judgment of the Patent Office the cornerstone of our patent system. Seldom if ever is an issued patent declared invalid by a court on the basis of the same facts and record known to the Patent Office at the time of the grant.

The provision of a definite yardstick for determining the existence of an invention is not alone sufficient. There must also be some assurance of a uniform application of the yardstick. The validity of a patent is now passed upon initially by any one of almost a hundred district courts in the United States, by eleven different circuit courts of appeals, and occasionally by the Supreme Court. The test of invention should be the same and uniform whether applied in the Patent Office or in any one of these courts. The only divergence in opinion should come from a divergence of facts. If, during the adjudication of a patent before a district court, new facts and evidence unknown to the Patent Office are submitted, the Patent Office should have an opportunity to revise its former opinion and to restate its conclusions on the basis of the additional information.

The Commission therefore recommends that whenever the validity of a patent is attacked in an infringement suit before a district court, the court shall certify the record to the Patent Office for a report on the validity of the patent. The report of the Patent Office as to the effect of the court record upon the validity of the patent shall be advisory only.

CREATION OF A COURT OF PATENT APPEALS

As a final step in remedying the chaotic and confusing conditions surrounding the grant and validity of patents the Commission considers it imperative to establish a single court of patent appeals which would receive and decide appeals from all of the district courts in patent cases and whose decisions would be effective not only in a particular circuit but throughout the whole United States. This is not a novel suggestion. A single court of patent appeals was recommended by the Science Advisory Board, appointed by the President on July 31, 1933, and has received the consideration and approval of a number of prominent manufacturing, engineering, and legal associations, and was recommended in the final report of the Temporary National Economic Committee. It has also been favorably reported by the Senate Patent Committee after full public hearings.

The creation of an entirely new court is not necessary. The Commission notes that the Court of Customs and Patent Appeals has now become a seasoned tribunal whose judges are trained and experienced in patent law. With expanded jurisdiction and additional judges this court could function as a single court of patent appeals. Already possessed of appellate jurisdiction from the Patent Office this court, in its exercise of appellate jurisdiction from the several district courts, would tend still further to promote the adoption of uniform standards of patentability.

The Commission therefore recommends the establishment of a single court of patent appeals. It further recommends that the jurisdiction of the existing Court of Customs and Patent Appeals be expanded so as to function as such a court, that provision be made for the court to sit elsewhere than Washington, and that additional judges be temporarily assigned to the court by the Chief Justice of the United States in such numbers and for such time and at such places as the public interest may require.

EARLY TERMINATION OF PATENT GRANT

It is desirable in the public interest to avoid deliberate delays after a patent application is filed. A proposal of long standing is that the patent monopoly shall not endure more than twenty years from the date of its filing in the Patent Office. This plan recognizes three years as a reasonable period for prosecuting an application to allowance. There would be no change in the present seventeen-year period of a patent in those cases in which prosecution did not consume more than three years. Any delays beyond that period, however, would ordinarily subtract from the duration of the patent. Thus, if an application were pending for five years, the life of the patent would be reduced to 15 years. This proposal also includes a provision for two additional years to the life of the patent, if a delay of more than three years has been due to causes beyond the control of the applicant, as it would be unfair to penalize applicants by the operation of the twenty-year law because a case encountered delays in the Patent Office.

SIMPLIFICATION OF APPELLATE PROCEDURE FOR PATENTS DENIED

When an application for a patent is refused by the Patent Office, existing laws provide relief to the inventor through

appeal to the Court of Customs and Patent Appeals or by filing a bill in equity for review in a United States District Court. In practice the latter means that the inventor must proceed to the District Court of the United States in the District of Columbia, because the District of Columbia is the only jurisdiction in which service can be obtained on the Commissioner of Patents. The need of these two parallel remedies has been questioned and it has been suggested that in ex-parte cases one court, such as the Court of Customs and Patent Appeals, is sufficient to review the denial by the Patent Office of an application for a patent.

PROCEDURAL REFORMS

Many details, which are in the category of patent-procedure reforms, are now being studied by the Patent Office Advisory Committee, appointed by the Secretary of Commerce in June, 1933. One of these is concerned with interference practice. An interference is a procedure to determine which of the rival claimants is the first inventor and therefore entitled to a patent. This procedure is unavoidable under the American practice, according to which a patent can be granted only to the first inventor. Disclaimer laws, disclosure of patent specifications, forms of claims, and other patent-procedural reforms are also being re-explored by the Patent Office Advisory Committee in the light of the recommendations made by the National Patent Planning Committee. It is hoped that these studies will benefit the inventor and investor by simplifying patent litigation.

GOVERNMENT-OWNED PATENTS

The National Patent Planning Commission is also making a study of the policy for the government with reference to inventions made by government employees and inventions growing out of research by government agents; the disposition of rights under patents resulting from such inventions; and the management and control of patents owned by the government. Our government now controls thousands of patents and many important patents will result from war research which is now being carried on for the government in war industries and at educational institutions. The policy of government with reference to these inventions is of major concern to our profession and to American industry. Suggestions will be welcome as to a policy for our government with reference to patents it now owns or controls and with regard to inventions made under its sponsorship. It is hoped that the Commission will be able to suggest a policy for the patent problems of government which will fully protect American industry and which will adequately reward the inventor in the employ of government and of its agents.

STIMULATION OF INVENTIVENESS

The most important phase of the assignment of the National Patent Planning Commission is covered in the last part of the President's order and relates to the problem of stimulating inventive talent for the purpose of utilizing the expanded war industries during the postwar period. What should our government do to stimulate inventive effort and what plans and incentives should be developed to encourage research and invention which will increase commerce, provide employment, and fully utilize defense industrial facilities during normal times?

Probably one of the greatest incentives to invention is a sound patent system. Among the other suggestions received are:

Government subsidies to research agencies and to inventors to develop their patents.

Shops and laboratories to be provided by the government in order that the inventor may be able to build and test his invention.

Loans to inventors in a manner similar to loans to farmers.

There is a growing feeling that research and invention may be stimulated by making it possible for amortizing the cost of research, development, and commercialization of a patent out of the earnings from the patent. Thus, taxes on inventions may well be postponed until a profit on the patent has been realized.

Biographies of inventors and inventions, if used in schools, may stimulate inventiveness in our young people.

A peacetime agency, similar to the Inventors' Council, has been suggested.

There is a feeling in certain circles that the requirement of blanket assignments of inventions by employees to their employers places the inventor at a disadvantage.

The problem of stimulating inventiveness is of special concern to the engineering profession as well as to the public at large, if the technical skill and equipment which we are now building up to meet the needs of the war effort are utilized most effectively to provide full employment and a higher standard of living when peace becomes a reality. Radio emerged from the first World War to become a great industry. It is conceivable that the inventive talent of Americans, if fully stimulated, will provide many novel devices and create many new industries which will enable us to win the peace that follows the war. In connection with this important part of the task of the National Patent Planning Commission, suggestions from members of the engineering profession can be of great assistance.

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In this paper I have endeavored to summarize some of the problems which have been and which are being considered by the National Patent Planning Commission. Its first report was presented to the President in the spring of 1943 and will be followed by other reports which, it is hoped, will prove helpful in enhancing public confidence in our patent system while encouraging interest in inventions and in their utilization for the benefit of humanity. This country is more in need of a patent system today than at any time in its history, if maximum use is to be made of our inventive talent to insure victory in mechanized warfare and to utilize most effectively our talents and facilities when peace becomes a reality.

The past three years have witnessed many changes which are greatly challenging the ingenuity of our profession. Our former abundance of manpower and raw materials now seems like a mirage, as acute shortages have developed which have seriously threatened not only industrial and civilian needs, but also our entire war effort. It is to the lasting credit of engineers and scientists that our country has been able to overcome threatened shortages by developing substitute materials by better integration and utilization of existing facilities, by improved training techniques, and by superior management. Our country is now producing war materials never matched even by the German war machine after years of preparation, even when concentrating the utmost effort of the enslaved countries. War incentives have stimulated invention which has resulted in new devices of great value to our armed forces. While some of the inventions of the past three years must remain military secrets, many others should be protected by patents in order that they may be commercialized for the benefit of humanity. It must also be realized, however, that new wealth to replace the losses we are suffering in this war can come at least in part through the research laboratory. A sound patent system is the very life-blood of many of our industries and is absolutely essential for the protection of the investment in research laboratories, which are bound to be important assets in utilizing most advantageously our present expanded industrial facilities in the postwar period. War and postwar needs require a sound patent system.

SHOULD UNIONS BE MADE "RESPONSIBLE?"[1]

By DOUGLASS V. BROWN

MASSACHUSETTS INSTITUTE OF TECHNOLOGY, CAMBRIDGE, MASS.

RECENT events, particularly in the coal-mining industry, have served to bring into sharp focus many questions concerning the role of unionism in our economy. Quite properly, these events and the questions which have arisen in connection with them have been considered primarily in the light of the war situation. The paramount importance of the war effort should not, however, be permitted to obscure the need for a consideration of the longer-range problems which may stem from the existence of unionism on a scale substantially different from that of the prewar and particularly the pre-thirties period.

A discussion of these longer-range problems is the chief purpose of a recent book by Joel Seidman.[2] While some attention is paid to wartime developments, the emphasis throughout is upon those questions which have arisen in the past and which may have to be faced in the future. Mr. Seidman, prior to his entry into the Army, was a field examiner for the National Labor Relations Board and may be presumed to have had an intimate acquaintance with the questions on which he writes.

A goodly portion of the book is spent in reviewing past excesses and reprehensible practices on the part of employers and law-enforcement agencies in their dealings with labor. Most of this material is familiar to those who have made any effort to inquire into these subjects. So is the material dealing with court decisions and the attitudes of the judiciary. In the interests of perspective, however, it does no harm to refresh our memories with reference to the obstacles which, rightly or wrongly, were placed in the way of labor organizations and which, to a greater or less extent, determined the nature and the practices of such organizations. It surely does no harm to point out that many of the antiunion efforts were, judged by any standards, outrageous and unworthy of a democratic country.

In his treatment of these matters, as well as in other sections of his book, the author demonstrates his sympathetic attitude toward unions and their objectives. On the other hand, he makes no effort to gloss over the unsavory practices which, on too many occasions, are manifested in present-day unions. Discrimination with respect to membership, racketeering, failure to hold conventions or to permit honest intraunion elections, discriminatory expulsions or suspensions of members, arbitrary and exorbitant initiation and permit fees, unreasonable obstructionist tactics toward technical improvements, collusion with employers in price and wage fixing—these and many other activities are discussed in a frank and objective manner.

Having outlined the abuses which have appeared in the past, both by and against unions, the author proceeds to a consideration of the proposals which have been made with a view to the regulation of union activities. Two basic attitudes seem to underlie the analysis of these proposals. The first is an evident conviction that self-regulation and house cleaning by the unions themselves is preferable to regulation imposed by government, and that unions would be well-advised to undertake such measures. The second is the recognition that the status of unionism in this country has changed, and that regulatory measures must now be evaluated in the light of this change. Prior to the thirties, if the cards were not exactly stacked against unions, these organizations may perhaps be said to have been relegated to the role of kibitzers. Now, however, unions are the recipient of governmental encouragement, and they have grown in membership and power. Formerly, many abuses could be condoned because of the obvious handicaps under which unionism was struggling. Now, the labor movement has obligations corresponding to the status which it has attained.

Mr. Seidman's specific suggestions for remedial action are interesting. He rejects, quite correctly in my opinion, the shibboleths of "incorporation" and "publication of financial statements." In his judgment, the requirement of incorporation would place upon unions an obligation which is not imposed upon any other type of association, and would not in any way add to the financial responsibilities of unions under common and statutory law at the present time. (It is interesting to note that a Colorado court has recently declared unconstitutional those provisions of a new state law which would require unions to incorporate, largely on the grounds that such a requirement is made in no other line of activity.)

Similarly with respect to requiring unions to publish financial statements, the author feels that nothing will be gained by the imposition of such an obligation, and that actual harm might result. As he points out, many unions already publish complete statements. In the case of young and struggling unions, publication of figures would only serve to advertise the weakness of the organization to possible adversaries who might be quick to take advantage of it. In any event, financial statements can easily be concocted to show, or conceal, whatever it is in the interest of those who make them up to show or conceal. The author concedes, however, that it may in the future be necessary to insure that union members themselves receive full and accurate statements and that they be protected against fraud and loose handling of funds.

Mr. Seidman further points out that these two common proposals are frequently made by persons whose motives may be considered suspect. There is reason to believe that, in some cases, the purported objectives of the proposals are not the real goals. Rather the hope is that the imposition of these controls will provide the basis for more thoroughgoing restrictions which will destroy the unions' effectiveness. Such restrictions might come about in the course of refusing charters of incorporation, limiting "corporate" activities, or exercising rigid control over the purposes for which unions could make expenditures.

As indicated before, the author prefers that unions undertake to put their own houses in order, and hopes that they will be so successful in their endeavors that governmental regulation on a broad scale will be unnecessary. He feels, however, that immediate governmental action on two points is in order. The first point deals with inequitable restrictions on membership, the second with disciplinary procedure within unions.

It is the author's suggestion that undesirable activities falling in these two categories be made unfair labor practices, investigation of which would be made by an administrative agency such as the National Labor Relations Board. Under the first heading, the Board would be charged with the duty of proceeding

(*Continued on page 28*)

[1] One of a series of reviews of current economic literature affecting engineering, prepared by members of the Department of Economics and Social Science, Massachusetts Institute of Technology, at the request of the Management Division of The American Society of Mechanical Engineers. Opinions expressed are those of the reviewer.

[2] "Union Rights and Union Duties," by Joel Seidman, New York, N. Y., Harcourt, Brace and Company, New York, N. Y., 1943.

DESIGN *for* MASS PRODUCTION[1]

How the Engineering Department Can Help the Tooling Man, Particularly in the Aircraft Industry

PRACTICAL aspects of the relationship between design and mass production aroused lively interest at the 1943 Semi-Annual Meeting of The American Society of Mechanical Engineers held at the Biltmore Hotel, Los Angeles, Calif., June 14, 1943. Eight topics were discussed by a panel consisting of George Perelli, vice-president, Consolidated Vultee Aircraft Corporation, George Betts, manager, tool, engineering department, Lockheed Aircraft Company, Stanley Carpenter, assistant chief, division of engineering, Consolidated Vultee Aircraft Corporation, R. E. Watson, superintendent, Vernon Plant, Douglas Aircraft Company, R. R. Nolan, manager, production engineering, Northrup Aircraft Corporation, A. W. Davies, superintendent of tooling, Santa Monica Plant, Douglas Aircraft Company, Robert H. Boden, section leader, development section, Lockheed Aircraft Corporation, and John S. Halterman, department manager, tool engineering, Vega Aircraft Corporation. Prof. T. A. Watson, University of California at Los Angeles, presided and introduced the speakers. After each of the principal speakers had concluded the presentation of his views there was further discussion from the floor. Most of the discussion centered on the present problems of aircraft manufacture, but consideration was given also to the relationship between tooling and production in the postwar era.

The following comments on the questions before the panel have been condensed from a stenographic report.

Mass Production in the Aircraft Industry

BY GEORGE PERELLI

VICE-PRESIDENT, CONSOLIDATED VULTEE AIRCRAFT CORPORATION

BEFORE I go into a detailed discussion of production problems as they affect the aircraft industry, I may contrast these problems with the production problems of old-line mass-production industries. Perhaps the best comparison we can make is with the methods and problems of the automotive industry. Over a great many years it developed very highly a mass-production technique which is pretty generally applicable throughout that industry and also in some allied industries. That same technique, however, has not been, and in my opinion cannot be, applied to the aircraft industry. Somewhere between our present methods of manufacture, our present design types, our present inspection requirements and those of the automotive industry, lies the field we are seeking. I do not believe we have found that field as yet. One of our most expensive factors, and perhaps one of the greatest consumers of time, is our riveting problem. Today there is no agreement in the aircraft industry as to what constitutes an acceptable riveting standard. All of you who have had acquaintance with that problem realize there is no standard of quality other than a personal opinion. We continue to reject what in somebody's opinion is a poor rivet and replace it with what somebody else thinks is a rivet of less quality than the one we took out.

The same may be said of our requirements in drilled holes. It was not long ago that we were not allowed to punch holes in dural. We have overcome that recently, but just how far we can go toward acceptance of mass-production methods is a question for which we are all seeking an answer.

Recently there was discussion in Detroit on the practicability of redesigning for mass production our well-known supercharger. The design had been developed over a period of twenty years by various manufacturers. Then it was taken hold of by the automotive industry to be redesigned for a more efficient production setup. However, the design we are now getting in production is practically that which was built up over a period of twenty years. The point I want to make is that they were unable to improve the design for mass production.

I believe the production people will always be able to find a way to build that which is required. Whether it can be done on a real mass-production basis is another thing. If we can improve our technique so we can lower our costs, that is our object. But in the event we are unable to improve our design so that we can lower costs, then it becomes the problem of the production people to find a way to manufacture the article on the best basis they can, whether it be on what we commonly think of as a mass-production basis or not.

DISCUSSION

In the discussion that followed Mr. Perelli's talk, Mr. Betts pointed out that the automotive industry does not now know much about aircraft, but that it may learn more about aircraft after the war and find ways to apply its production technique so as to give the present aircraft industry real competition. Mr. Carpenter, on the other hand, thought that the automobile companies might be able to learn something from the aircraft industry. Mr. Watson referred to the difficulty of applying mass-production methods when military requirements necessitate frequent changes in design. Mr. Boden expressed a similar view. The aircraft industry, he said, has specialized on flexibility of design rather than rigid standardization and mass production.

Do the Same Principles Apply to Manufacturing and Tool Engineering as Apply in Other Engineering Fields?

BY GEORGE BETTS

MANAGER, TOOL ENGINEERING, LOCKHEED AIRCRAFT COMPANY

GOOD practices are necessary in all types of engineering. The basic fundamentals of aeronautical structure and mechanics are the same as those used in tool engineering, and vice versa. Assembly fixtures are subject to loads which cause deflections similar to those for bridges or other structures. Too much strength where it is not needed, or too little where it is needed, are the results of a "best guess" type of tool engineering often used in the past.

It is readily apparent that tool engineers and mechanical engineers are concerned with design problems which are similar. The application of good engineering practice to tool engineering offers another field in which the mechanical engineer can apply his training and background to good advantage. The mechanical engineer who uses his training and understanding

[1] Condensed from a Panel Discussion held at the 1943 Semi-Annual Meeting, Los Angeles, Calif., June 14–17, 1943, of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

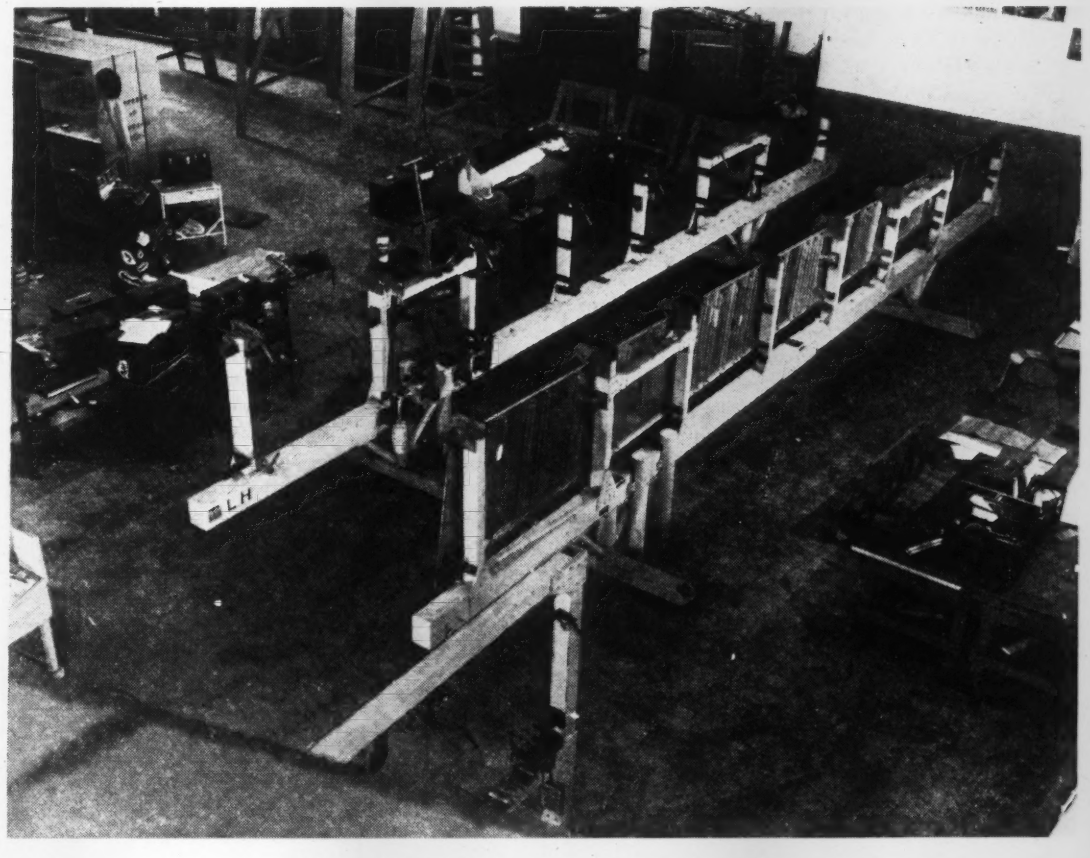


FIG. 1 TYPICAL SINGLE BEAM CONSTRUCTION FOR MAJOR JIG USED BY LOCKHEED

of the problems of tool engineering will produce a better design for production. If he will take into consideration design from the standpoint of strength and rigid position in which the assembly will retain its shape and the tolerances required, the problem of the tool engineer will be simplified and the resultant product will be the best available.

Better results will come if the tooling engineer and product engineer work in close contact while designing the product. It will then be possible for the product engineer to incorporate the requirements of the tooling engineer to provide a tool with maximum accessibility to perform the function required as economically as possible.

DISCUSSION

Mr. Davies pointed out that we frequently confuse methods with fundamentals. Fundamentals don't change, but in the early days of an industry we may pick up methods from some other industry that do not directly apply to the materials and machines being used. That is brought out, he said, in the machining of magnesium alloys, where the aircraft industry has used tools designed for cutting steel. Mr. Boden expressed the idea that there is a tendency in the tooling divisions of all companies to put forth great effort to organize the knowledge they have gathered over the past few years. If this knowledge is brought to the attention of the mechanical engineer, then in turn his training and imagination are brought to bear on tooling problems.

A speaker from the floor said he thought collaboration between the two engineering departments, tooling and design, is more in the dream stage than in practical application. During his career with a local aircraft company, the tooling department had seldom been notified of a design until the design was approved, when it was given to tooling to work out the problem. More progress can be made to bring tooling into collaboration with the design engineer.

Another speaker from the floor asked the difference between the mechanical engineer and the tooling engineer, to which Mr. Betts replied that "Mechanical Engineer" is a general term for a graduate engineer, while "Tooling Engineer" is a specialized term for an engineer who has specialized in tooling and in all phases of it. Mr. Davies and Mr. Perelli concurred in this view.

How Can Engineering Breakdown Drawings Aid in Tooling Changes?

BY STANLEY CARPENTER

ASSISTANT CHIEF, DIVISION OF ENGINEERING, CONSOLIDATED VULTEE AIRCRAFT CORPORATION

THE primary function of production engineering is to furnish information for the operation of the manufacturing departments. Production engineering might better be called "product engineering." This type of engineering recognizes the problems of all departments.

Much can be done by the engineering department to assist tool design. Some of the things engineering can do to help are very elementary, and yet they are of great importance to tooling. Another $^1/_8$-in. edge distance for rivets or a slightly larger boss for drilled holes can in most cases be granted to account for tolerances, without which tooling costs and scrappage of parts skyrocket.

Consultation with tooling during the initial phases of design can do much to permit the best possible arrangement from a production standpoint. Without this co-ordination during the initial stages, design might progress to completion only to be changed for reasons of tooling. Recognition of limitations in forming is an important factor in production as well as tooling. Very often an improper choice of materials for forming may be made by engineering and this might contribute to costly delays.

Present-day demands of engineering require versatility to use the materials at hand quickly and with minimum tooling changes. At Vultee Field Division, trainers are manufactured with a fairly low material priority and reserve material stock. Unfavorable changes in the material status have necessitated re-engineering and retooling. Sometimes the going has been tight and we have had our share of headaches to keep the line moving. But out of it all much has been learned of new materials and their uses.

One quick change to conserve aluminum-alloy sheet was accomplished by the use of phenolic sheet in secondary structural applications. This substitution made it possible to use all existing tooling for routine operations. Only minor changes were required in the assembly tooling to account for the slight increase in material thickness over the aluminum alloy.

Progress in development of aluminum-alloy castings together with greater allowable loads has been used advantageously in simplification of design. In one instance we were able to replace with one piece a built-up sheet-metal assembly consisting of nineteen parts. This is perhaps the exception rather than the rule, but it is indicative of simplification possible with castings. Recent requirements to eliminate forgings were accomplished by the use of castings in 44 of 47 forgings for our trainers. In all cases the conversion was effected without destroying interchangeability between the forgings and castings. In some instances, however, it was necessary to use steel lugs bolted in place by the use of taper pins where castings did not provide sufficient strength around the bosses.

Schedules of the engineering department are one of the most important phases of plant operation. The entire factory operation is dependent on the scheduled release of engineering information. If there seems to be a delay it should be reported immediately rather than wait until the due date. Manufacturing operations can usually be adjusted accordingly. Failure to report delays in schedules may penalize other departments.

Basic configuration is one of the first phases of airplane design and is established primarily by engineering, although adjustments and compromises are made in consultation with tooling to arrive at the best practical design. As detail design progresses, the breakdown of engineering drawings becomes increasingly important to both engineering and tooling from the standpoint of efficiency in production and airplane performance. Considerations such as size for handling and ease of accessibility for assembly operations affect decisions of the breakdown. Size for shipment of spare parts is also a factor. The order of subassembly into the complete assembly must be furnished by tooling, and engineering can design accordingly. Production variations in the subassembly and proper analysis of the effect of these variations to assembly operations must be studied. It may happen that a particular subassembly shifts in manufacture from riveting or welding so as to consume an excessive amount of time.

Here redesign can aid tooling in several ways. For example, improved accessibility can be provided to permit drilling or machining as a final operation.

Too detailed a breakdown of major assemblies is undesirable. Subassemblies going into those assemblies, however, can sometimes be designed by engineering to permit a wider distribution of manpower for flow of work into the main assembly jigs. A breakdown of production in this manner will permit accumulation of a bank of parts for the assembly operations.

The engineer is especially interested in reducing the number of assemblies to a minimum. Weight increases as the number of assemblies increases, because fittings must be provided to transfer the load from one assembly to another. Uniformity of

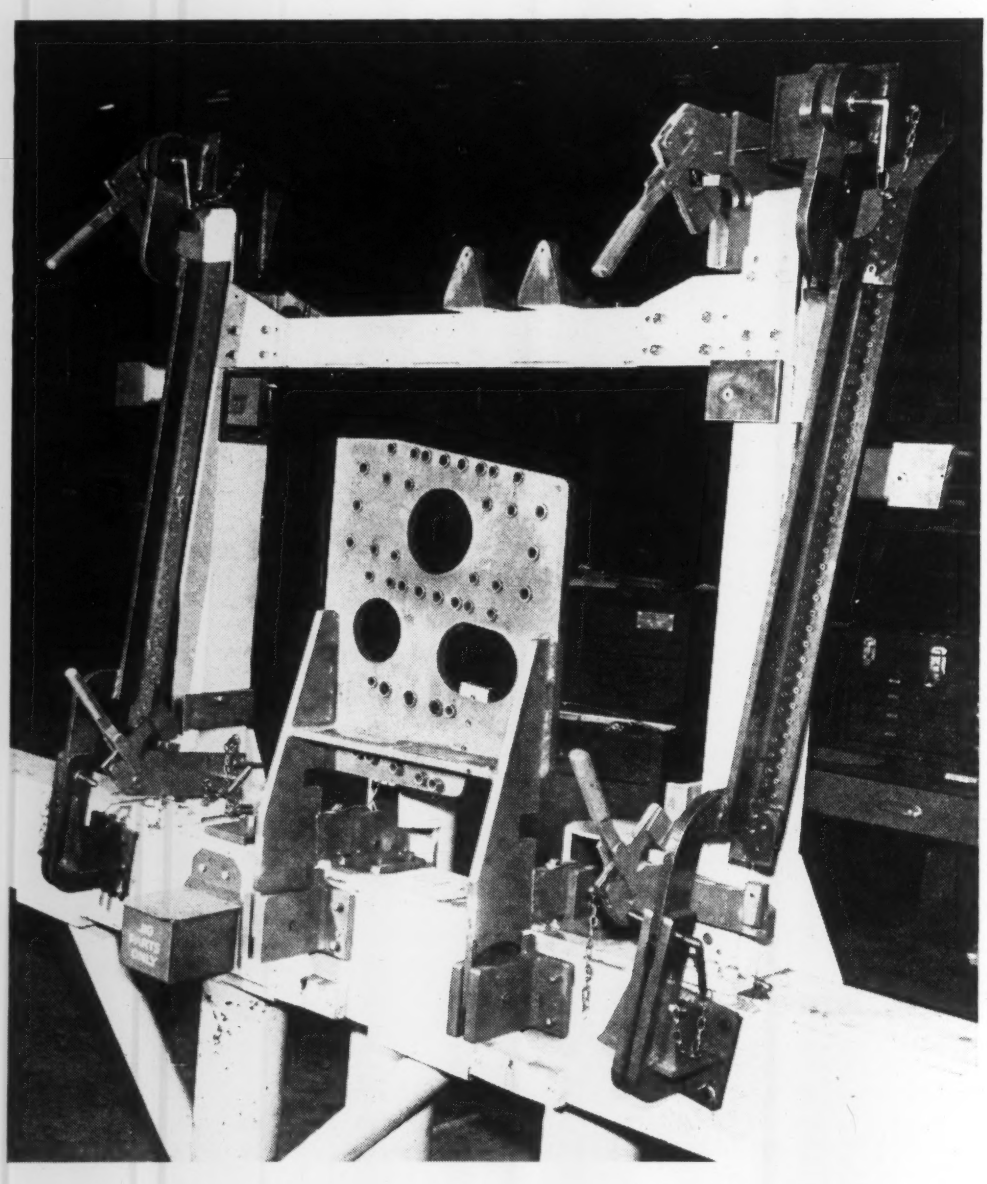


FIG. 2 SUBSIDIARY FRAME, LOCATORS, AND DRILL PLATES ON A TYPICAL SINGLE BEAM JIG—LOCKHEED

product, aerodynamically and interchangeably, is a direct benefit when major assemblies are reduced to the minimum number.

DISCUSSION

In the discussion which followed, Mr. Perelli said, "In one of our divisions we have completely divorced production engineers from the design-engineering group. In my judgment that is the most satisfactory way of operating, with assistance from the engineering department to the production or tool-design people. I believe about the only restriction placed on the production engineers with a specific model is that they cannot change the airplane aerodynamically. Materials and strength all come under the control of design engineering, but it is the responsibility of the product-engineering department to design and execute for production.

"In one of our divisions we attempted a compromise setup wherein a production-engineering department was set up without authority to enforce. It was charged with the responsibility of recommendations to the engineering department of desirable production changes, without the authority to enforce those changes. We found that was not a satisfactory way of operation."

Carl Harrison of Lockheed asked Mr. Perelli how the product-design group can get at the actual basic types of construction after the original developed design has been completed. For example, if a three-spar wing is chosen, can the production group change it to a no-spar wing, etc.? In answer Mr. Perelli gave some specific examples. "In the design of a fighter model recently they insisted on heat-treated rivets. They had a big argument about weight saving. We got into the line and insisted on untreated rivets and won the argument on a basis of cost. I think the sacrifice of weight of the entire airplane was 54 lb. (Note: This figure was later reduced by one half.) We convinced them that the cost savings in production would outweigh many times the cost of taking care of 54 lb weight in the airplane. There are practically no limits within which the production-engineering department cannot operate if it does not affect the strength and safety of the airplane. We have redesigned many sections of the airplane.

"It has taken about a year to get a new catwalk in the B-24, but we have finally done it. The responsibility of that department at the time we started was not as great as now, and the design was shelved because the engineers had more important things from their standpoint. By keeping up pressure, we finally made our point."

Al. Peterson of Vega doubted whether it is possible to make a design right the first time for production and for function. That seems to be where the tool engineers and mechanical engineers fall out. After it is made the thing has to function on the airplane. We are subjected on the part of the tool engineer, he said, to a matter of opinion. One tool engineer gives all his attention to details, and we are subjected to a lot of criticism about detail parts. The next tool engineer wants to break the airplane down to a bunch of subassemblies. However, there must be a trend toward the mass-production idea and help can be had from the tool engineers. Perhaps riveting is the wrong way to do a particular job and it should be spot-welded. Maybe instead of aluminum we ought to use cold-rolled steel. If enough tool engineers "bunched down our necks," he said, we would try it.

A speaker from the floor asked Mr. Carpenter how they overcome the weight problem in substituting castings for forgings in the production program. In reply Mr. Carpenter said, "The weights do not come out exactly the same. We took a little penalty, but in most cases we were able to duplicate the weight of the forging, principally for the reason that the forging was overstrength on account of minimum sizes for forgings. I think our conversion from forgings to castings cost us about 10 lb."

In answer to a comment that the aircraft industry wastes a lot of ingenuity on complicated planes which could be simplified for mass production as has been done with the automobile, Mr. Watson pointed out that the automobile industry ordinarily makes a change once a year, while the aircraft industry is requested to make changes almost every week, and therefore the tooling must be kept flexible. We are tooling, he said, not for permanent design but for change. That is important during military periods.

What Is the Contribution of Master Tooling to Mass Production?

BY R. E. WATSON

SUPERINTENDENT, VERNON PLANT, DOUGLAS AIRCRAFT CO.

MASTER tooling is used primarily to guarantee interchangeability. The need was limited to mating surfaces at the time aircraft were fabricated by custom-built methods in small quantities. But when military and civilian requirements demanded increased production and servicing in all parts of the world, it became necessary to use methods and tools to guarantee interchangeability.

Master fixtures also make it possible to use partially skilled help in the fabrication of assembly tools. The fabrication of assembly jigs with masters is a matter of lifting prints and surfaces already established by the master.

Master tools as we designate them fall into the following five classifications: (1) master diagram, the basis of all critical dimensions. These dimensions are calculated from engineering data and charted for use in the design of master tools; (2) master layout, in which the engineering data, the tooling data such as developed sections, tooling hole locations, and co-ordination data are combined; (3) master plaster patterns, which are used as the source of all fabricating data on compound surfaces; (4) master fixtures, used for the fabrication of assembly fixtures; and (5) inspection fixtures, commonly known as inspection gages, which are used to inspect parts or assemblies to guarantee interchangeability. These master gages came as a direct result of having assemblies built by various vendors in different parts of the country. This necessitated some type of gage to insure interchangeability.

The simplest type of master we have is a master tool we use on our simpler forms of fabrication. It is merely to guarantee the mating of surfaces. We have a master of more complicated type which combines matching surfaces together with compound surfaces to be duplicated, to simplify the fixtures. This way it is possible to guarantee the interchangeability of the entire structure as well as of the parts which make up the structure.

Then we get into another type of master which is the direct result of an attempt at mass production; in other words, the breaking of the fuselage into two portions. This necessitates the fabrication of master tools where all parts can be set and attach points located. We have also what we term a control master, or a master to build masters. This is brought about by the fact that in present-day production we are forced to build the same airplane in more than one location. These control masters have two functions; first, to fabricate the original master, and in case of damage to the master to permit the critical points to be reset. Control masters never leave the home plant.

DISCUSSION

Mr. Nolan expressed the opinion that one of the basic problems of modern production which has encouraged master tooling is the development of subcontracting, where major components are built across the country and it is necessary to supply contractors with definite information. That is easy to control within a single plant, but with geographical separation it is very necessary to have masters of the type which Mr. Watson described, especially the control master, which is a master for

masters. Another important phase of master tooling is the fact that tools also are built on a production basis. The time was when one set of assembly jigs was sufficient. Now, many companies have dozens of a single type of jig.

Mr. Halterman summarized the problem, saying, "We may have a row of holes that are equally spaced, say four inches apart. The whole row is four feet long. This row of holes is matched up with another row of holes which originates in a different tool. It is necessary in many cases that a slip-fit bolt can be pushed in with the thumb. That requires drilling and reaming down almost to a hair. It is really necessary that when the parts originate at different temperatures and in different physical locations and are brought together that they match, because in many cases these parts have to be changed in the field, and subassembly or modification points are not equipped with the necessary tools to make holes oversize or elongated, so it is necessary that they are mastered to the *n*th degree."

"It has been my thought for a long time," Mr. Perelli said, "that the time to originate the control master is at the same time the prototype airplane is being built. I have had considerable experience with models where the prototype was built, and then additional airplanes were ordered and the problem of interchangeability came up, and we thought of the control master. I believe that when you invest a million or two million dollars in a prototype airplane, a hundred thousand additional in control masters is well spent."

In response to a question about thermal expansion, Mr. Davies said that it is necessary to use judgment in tooling certain portions of the airplane to take care of expansion and leave a joint that will be made on assembly. There are certain portions of an airplane that cannot be interchangeable, particularly on large planes, and those have to be left blank and drilled on assembly, whether it is as spares or in the factory.

Answering a comment that plaster masters are not very satisfactory Mr. Watson pointed out that the term "plaster masters" is a misnomer. Use is now being made of a product which sets much harder and is not affected by moisture the same as casting plaster. It is commonly known as Hydro-Cal.

Lessons can be learned from both German design and from British design with respect to interchangeability, according to Mr. Perelli. Great Britain faced that problem long before we did, with her extended colonies all over the world. The British achieve interchangeability by adjustability. On one British design, the wings are fastened with hydraulic latch hinges. It runs oversize and heavy, but they may have to take the airplane down in the desert or in India and insert a new latch pin, so they made everything oversize and the pin could be easily inserted by a light finger pressure. He suggested that a compromise could be made and accomplish a great deal toward solving the problem of interchangeability.

What Is the Application of Lofting and Master Template to Tool Design?

BY R. R. NOLAN

MANAGER, PRODUCTION ENGINEERING, NORTHRUP AIRCRAFT CORPORATION

ENGINEERING supplies the basic configuration of the airplane. The engineers determine in what shape they want it built. The actual refinements of that shape, streamlining and providing definite contours for manufacturing purposes, is "lofting." The term "loft," historically, was first used in shipbuilding, and is now applied to aircraft, although the original meaning no longer exists. In the past, streamlining and the carrying out of a three-dimensional shape was gone about mechanically, with a great deal of opinion injected into it. A man with a good eye was a good loftsman. He could make a good curve with battens, strips, and splines. The modern approach is a definite science of curves, graphic calculus, and other mathematical means.

Templates are the means by which lofting data are transferred to the shop. The loft furnishes to the tool designer and other tooling phases the basic angles, offsets, and other data by which master charts are prepared. A very important aspect of lofting is the development of what are known as master loft boards or master layouts. These are full-scale layouts of an assembly, such as a rib or fuselage section or stay in which every design of that item is laid down in metal, so that any change in engineering is first made on these masters to see how it affects relative parts. And from this master loft the templates are lifted.

In a sense the loft is a master tool in itself, because it is the Bible from which all working data are supplied. In addition, these master lofts are duplicated by photographic process, direct contact prints, and other means and serve sometimes as the actual basis for the tool. They are sometimes bolted to steel or wood end plates, and simple jigs are built directly from them. They are duplicated and reworked in the event of one of those changes which come to pass in military aircraft. The basic loft data which are supplied from structure stations in the airplane establish the basic contours by which the total airplane is built. In cases of wings it is usually arrived at by development prior to lofting and is demonstrated by co-ordinates. The contour is developed by the co-ordinate itself or in conjunction with technical instruments. These masters never change unless the actual airplane configuration changes, in which case it would be a major design change of the airplane.

DISCUSSION

Mr. Davies pointed out that nobody has a definite answer as to how master lines are going to be reproduced to definite advantage. The camera is used to reproduce single templates. The direct reproduction process, using a sensitized glass plate, full size, will give exact reproduction. Then there is the pliofilm process for lifting of whole patterns, a chemical process by which the design is lifted up and transferred to a sheet of metal, and the whole pattern is used to make a master drill plate for the holes involved in the layout.

What Is the Effect of Engineering Breakdown Upon Subassembly and Assembly Line Tooling?

BY A. W. DAVIES

SUPERINTENDENT OF TOOLING, SANTA MONICA PLANT, DOUGLAS AIRCRAFT CO.

WE have used the "mass production" term frequently this evening. The best definition I know of it was given by Lieut. Gen. Knudsen some time ago: "Fabrication of detail parts so accurate that they go to final assembly lines and into the assemblies without reworks." That is a good definition, because it takes tooling and production methods to produce the result.

A typical breakdown of an airplane is arrived at in our company through conferences of the engineering department, manufacturing division, and the tooling division. Before it is definitely established and the design proceeds, they are all in full agreement as to what this breakdown should be for the best results for production and assembly.

You may be interested in the results we have had with moving lines versus stationary lines. In moving lines the primary function is to specialize operations and standardize jobs. Recently it was necessary for us to put on a large percentage of unskilled help. In the stationary line where every person had a large number of operations the time went up 120 per cent. On a moving assembly line it went up only 20 per cent, because the operations were specialized and an inexperienced person could learn the operation in a very short time.

An airplane can be built in one jig from the nose section to the tail cone. On low production that is probably the best way

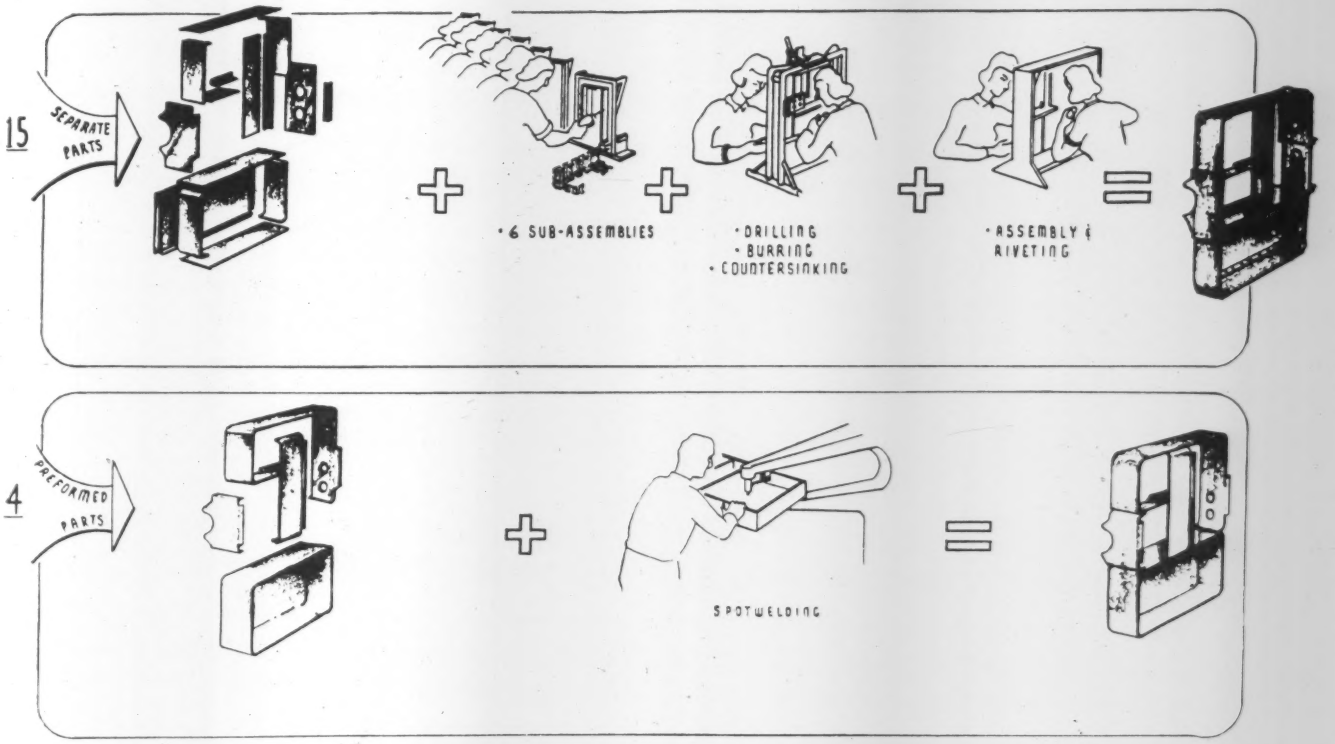


FIG. 3 COMPARISON OF PRODUCTION METHODS FOR SMALL ASSEMBLIES—VEGA

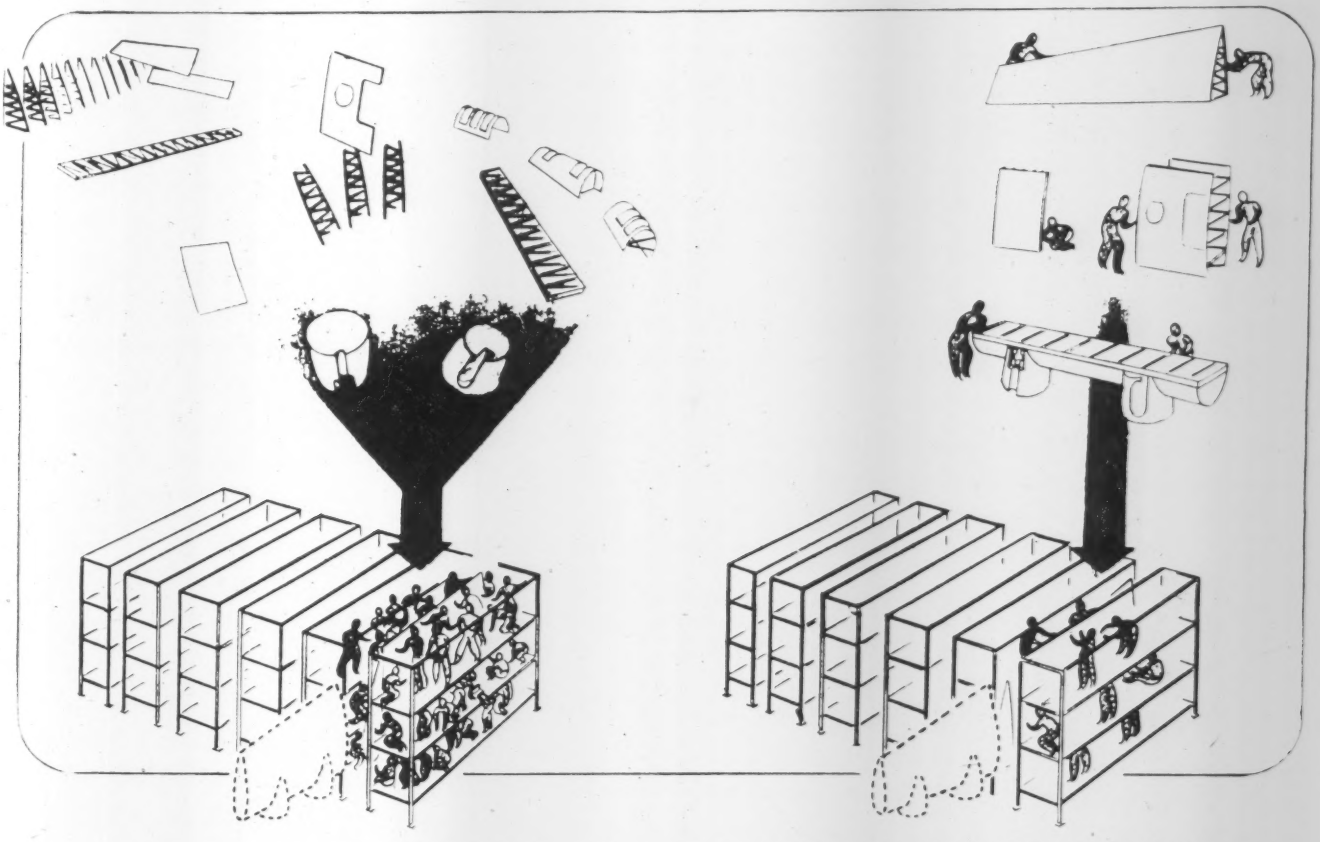


FIG. 4 HOW SUBASSEMBLIES CAN BE USED TO AVOID EXCESSIVE CONCENTRATION OF PERSONNEL IN ONE LOCATION

to do it. If production were increased by five times, we would find it to our advantage to split the work and build this part in one set of jigs and that part in another. We might find that we would save perhaps 40 per cent of our floor space, because we would only need half as many jigs for each part.

DISCUSSION

Mr. Nolan pointed out that one of the most fundamental of all present-day problems in airplane breakdown is to provide to shop breakdowns of such a nature that there isn't much to teach to the individual who is going to do the job. The ulti-

mate goal would be to reduce that training to the shortest possible period. On the other hand the problem is that the more you break down an airplane, the more you get into joints which are costly and also are weight drawbacks, so a compromise somewhere between the two is necessary. That is definitely the trend modern aircraft design is taking.

What Are the Possibilities in Standardizing Major Tools and Their Relation to Engineering Design?

BY ROBERT H. BODEN

SECTION LEADER, DEVELOPMENT SECTION, LOCKHEED AIRCRAFT CORP.

FOR a period of over a year we have felt that it might be a good idea to clean up our own back yard instead of going upstairs and checking up on the engineering department. In an endeavor to carry out this plan, our first step was to try to standardize on some typical major jig design. By doing this we hoped to take less time to design major jigs and master tools, and secondly, by turning out familiar designs to the jig builders we hoped to allow them to perfect a building technique which could be applied over and over again, thereby speeding up the manufacturing processes for the tools.

Our method of the present is to use a manufacturing standards manual. We have a single beam construction and a standardized box beam. These are built up from structural angles and intermittently welded. The surfaces of these beams are machined.

We have organized all of the structural data necessary for a proper analysis of our tools, and this information is compiled in the standards manual. The draftsman simply goes to our filing department and says, "I want the standard drawing with this number." They bring out a brown line and he fills in a legend, dimensions, and detail number and he is finished with that structural detail. It is sent to the welding shop, normalized, and returned and machined.

The typical single-beam jig which we use is approximately 300 in. long, but with standard extensions which we have available we can go up to a length of about 500 in. and still have a satisfactory tool. By means of this construction we have a simple jig and it is very accessible.

Our jigs are stable. We have made measurements and found they will not go out of alignment more than 0.005 in. over a period of a weeks' time. These tests indicate that we will have to do a minimum amount of mastering. The beams and joining plates of the structure and the standardized locators are salvageable. We have managed to obtain ninety to ninety-five per cent salvageability.

DISCUSSION

In the aircraft industry, according to Mr. Nolan, there are as many ideas of what constitutes a good jig structure as there are companies, although the trend is toward standardization. This is certainly a field where the mechanical engineer can step into the picture and assist, because there must be a correct way to design major structures.

In answer to a question from the floor about the basic difference between welded and bolted jigs, Mr. Davies said, "Welded angle-iron and channel and I-beam structures form practically all of our basic structures for major assembly jigs. We find the cost lower per pound. The idea of salvage was in our minds to start with. We used to tack-weld our joints so we could save material. We found it was cheaper to wreck the steel and scrap it. In the long run the whole cost of the tool, including scrapping the steel, was less than any other method we could design. We have considerable data to prove the economy of that basis of design."

What Would Be the Greatest Factors to Simplify Tooling and Assembly in Airplane Design?

BY JOHN S. HALTERMAN

DEPARTMENT MANAGER OF TOOL ENGINEERING, VEGA AIRCRAFT CORP.

ONE of the greatest factors to simplify tooling and assembly in airplane design is to design around a breakdown to assure a maximum amount of work in the installation and subassembly lines. Another is to reduce the number of parts in the airplane. These will help to reduce the cost of tooling and render the model quick to tool.

If fifteen parts are required to make the completed assembly of a certain unit and those fifteen parts are assembled in six subassemblies, and then after drilling, burring, and countersinking, they are assembled and riveted into the complete unit, there are ten people involved. If the unit was so designed that it could be formed in four parts and spot-welded, the complete assembly would come out with less time and effort, and less floor space and fewer jigs.

Similarly, an assembly that is made up of a number of small units brought to a large assembly fixture requires a large number of people working in one congested area, whereas, the same units put together as subassemblies need fewer people.

Conditions now require that we utilize every inch of floor space we have. Most of us are running more than one ship through, and in order to get the most efficiency we must be able to do as much work in decentralized areas as possible. So a breakdown such that installations can be made in subassemblies and the reduction in the number of parts, would be the best ways to simplifying design for mass production.

DISCUSSION

Mr. Perelli maintained it is not the cost of a square foot of floor space that counts, but the turnover got by using it lavishly. He said that those factories which use floor space lavishly have production records which justify the use of that floor space. Mr. Boden disagreed, feeling that floor space should be used as economically as possible. This can be greatly helped, he said, by engineering breakdown and finally by tool engineering applied to the general fabrication of the airplane.

Should Unions Be Made "Responsible?"

(Continued from page 1)

against such practices as racial discrimination in membership, unreasonable initiation fees, unfairly administered apprenticeship regulations, and arbitrary restrictions on the number of members. Under the second heading, there should be provided assurances of prompt and impartial review of union disciplinary actions, and of protection against discriminatory treatment. It is felt that both of these proposals are particularly important in situations in which a closed or union shop is in effect.

Failing successful efforts on the part of the unions themselves, Mr. Seidman feels that governmental intervention on other questions may become necessary in the future. Among these questions are included fair and frequent elections, strikes and picketing by minority unions, and jurisdictional strikes. Moreover, the author looks with favor upon the establishment of measures for "cooling-off" periods, provided they are combined with more adequate means for mediation and adjustment of disputes.

One need not agree with all of the conclusions of this book, only some of which have been touched upon in the present review, in order to profit from a reading of it. Interestingly written, the book offers a useful check list and a provocative discussion of a series of issues which have become of great importance to unions, to employers, and to the country as a whole.

WARTIME RESEARCH *and* DEVELOPMENT—A MOLDER *of* ENGINEERING

By HAROLD V. COES, PRESIDENT A.S.M.E.

VICE-PRESIDENT, FORD, BACON AND DAVIS, INC., NEW YORK, N. Y.

IN THE time at my disposal this evening I am going to try to give you, in condensed form, a preview of the results of wartime scientific research and development.

The hard inexorable pressure of war necessities is compressing into a few short years, sometimes even into a few months, research and development work that under normal peacetime conditions would be spread over years, sometimes over a generation or more, before the public begins to benefit extensively by that work.

Think of creating, in one and a half years or so, an entire synthetic-rubber industry to produce from 800,000 to a million tons per annum. This typifies what is going on in terms of time, volume, and money. Viewed without the vast backdrop of the theater of war, the accomplishment would be stupendous. Thanks to free enterprise, skilled and semiskilled workers, fine engineering, competent management and co-operation by government agencies, ships, tanks, guns, small arms, ammunition, airplanes, and power vehicles, to mention only a few wartime products, are being produced on a gigantic scale.

At the moment we are not concerned as much with the marvels of production, a gripping story all of its own, as we are with what we engineers are confronted with from the scientists' Pandora's box—the results of scientific research and development.

Dr. Charles M. A. Stine in his fascinating address, "Molders of a Better Destiny," points out that there is every likelihood that, postwar, we will have aluminum at a still lower price, with all that that implies, due to a capacity to produce in one year enough aluminum material to build three times the number of passenger cars now operating on all American railroads, or by the end of 1943, seven times our 1939 aluminum production, and this after fifty years of intensive development.

Dr. Stine further states in this excellent address: "We will be recovering, from brine or sea water and other sources, approximately 100 times the magnesium that was produced in 1939, when the magnesium industry in America was 24 years old. Magnesium is about 60 per cent the weight of aluminum. Measured by cubic feet, magnesium at 22½ cents a pound is cheaper than aluminum selling at 15 cents a pound. After the war the nation's capacity for producing this lightest of all structural metals will be more than double its aluminum output of 1939. We will probably have more aluminum and magnesium capacity than copper and zinc capacity after the production facilities are completed."

New steel alloys with tensile strengths of 190,000 psi are emerging. New ferroalloys may permit the use of temperatures up to 1100 F in power plants and chemical processes. If we find a way to produce beryllium more cheaply and can produce nickel-beryllium alloys commercially, products can be obtained that are highly resistant to fatigue under repeated stress, and a whole new sector is opened up for mechanical design. Two per cent of beryllium mixed with copper increases the tensile strength to 185,000 psi and renders the alloy heat-treatable. Two per cent of beryllium mixed with nickel raises the tensile strength of the alloy to 260,000 psi.

A transparent armor, proof against bullets, extremes in temperature, and dangerous sunrays in high altitudes, is in prospect for warplanes.

A new glass is manufactured in curved, triangular-shaped pieces. The pieces attain their contour in curved molds while being run through the furnace, a new technique recently perfected. Heretofore it was considered impossible to bend plate glass to required shapes.

This process probably will be applied to commercial products in the postwar era.

Just consider what these new structural materials, with plastics, aluminum, magnesium, synthetic rubber, and high-octane gasoline will do to just the automobile industry alone. Today every automobile is obsolete. Different and better springing, new noninflammable fabrics, sealed cooling systems, less weight, much higher output per cubic inch of piston displacement, considerably higher mileage per gallon of gasoline, tires that may run anywhere from 50,000 to 100,000 miles are some of the characteristics that seem to be emerging. Present-day automobiles are so obsolete that after the war is over and the newly designed cars come off the production line at a later date, we will rub our eyes, like Rip Van Winkle, and wonder how long we have been asleep.

The jeep may revolutionize the farm market. With few modifications and adaptions it could be the farm tractor, power plant, and truck, and also take the family to the movies.

Think what accelerated scientific research and development will do the aviation industry when warplanes and the lessons of the war are turned to the uses of peace and commerce. It is breath-taking to think about, aside from the possibilities for individually owned nearly foolproof planes, such developments as the helicopter, air express trains, cargo-carrying dirigibles, and the like. Instant-action heaters working in airplanes at frigid heights, point toward 15-lb units of a little more than a cubic foot that could provide warmth for a ten-room house.

The completion of another huge plant for the production of 100-octane aviation gasoline is one step nearer the day when all our planes will be able to carry still greater loads.

I understand that a large plane operating on 100-octane gasoline can carry approximately 5000 lb more load than one operating with 87-octane gasoline.

The chemists have already produced gasoline with higher than 100-octane rating.

The indications are that our fuel technology has already outstripped our mechanical technology in engines and accessory designs. Consequently, new engines and new materials to withstand much higher mean effective pressures are coming to the fore.

Presidential Address delivered at the Annual Dinner in connection with the Annual Meeting, New York, N. Y., Nov. 29–Dec. 3, 1943, of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

An interesting feature of these catalytic cracking processes for producing high-octane gasoline is that they produce large quantities of butadiene now used in synthetic-rubber manufacture. The new refining processes are making possible something equally important, a new chemical industry—esters, alcohols, solvents, and pharmaceuticals—all made from oil.

These plants are almost automatic in operation when the fluid catalytic process has been started, and although nearly 20 stories high in places and covering acres of ground, they are operated from a central control room with comparatively few operators.

Development of a new plastic has been recently announced by Dr. James M. Church, of Columbia University. This plastic, styled "thermo-cast," possesses a unique property which permits it to be melted and cast into shapes, without the use of pressure, similar in this respect to cast iron, but with greater exactness of mold dimensions. The base of this plastic is ethyl cellulose, one of the toughest of the raw-material plastics. It is said to be the only known plastic that can be used as a mold for other plastics, such as plexiglas. Its strength characteristics rival those of some steels, in many respects, but its weight is only one fifth that of steel.

Dr. Church states, "The chief drawback of any of the common materials employed in tooling operations has been either their great weight per unit of volume or lack of durability under severe conditions of metal forming operations.

"Another objection is the large amount of time in man-hours required to make metal forms to meet the exact dimensions required, which include first of all the construction of a suitable mold, then a casting of the oversized rough metal form and, finally, machining and grinding it to precise dimensions."

He also says the new plastic could be formed into dies in one third the time it takes to make kirksite dies, now used in the airplane-manufacturing industry, and that the speed of molding would be further improved.

This new plastic and new technique will undoubtedly have commercial application, not only for wartime products but for postwar products as well. Consequently, engineers need to consider the effect of this development on existing methods and techniques.

Plast-Anneal, a new trademarked product, made by spraying a thin plastic coating on metals, has a much greater resistance to salt-water corrosion than galvanizing. This might be termed "plastic galvanizing."

A new product called "bubbfil," resembling a transparent string of streamlined beads, is being produced by du Pont and it may replace kapok. Tightly packed the material weighs about $1\frac{1}{2}$ lb per cu ft. It will support about 20 to 30 times its weight of lead. It loses its buoyancy less rapidly than kapok. The material withstood tests equivalent to 50,000 ft altitude and a temperature range from —28 F to + 200 F. This material probably has some interesting applications.

Plywood bonded with waterproof resinous lamination has been developed to the point where brackets, reinforcements, and inserts can be molded integrally. This process produces a light remarkably strong wooden structure akin to welded metal structures, but 20 per cent or more lighter.

It has been used in this war for trainer planes, mosquito bombers, lifeboats, P.T. boats, mine sweepers, skis, bulkheads, knockdown buildings, and for other purposes.

Think what low-cost structural materials, plastics, new glass that will float, glass that will bend, plastic plywoods, ceramics and ceramic coatings, electronic devices, air conditioning units, new insulating materials lighter than cork and waterproof, new heaters, and new lighting automatically controlled will do to the housing industry, particularly in the low- and medium-cost home market.

Here again the rapid developments in scientific research need to be watched carefully by the mechanical engineer. The majority of these developments will, in my judgment, be far-reaching indeed for mechanical engineers, as well as for others, of course, who take these developed materials and utilize them in new designs and new products for the hungry markets that will exist after the cessation of hostilities.

David Sarnoff recently stated that microwaves can be used to heat, dry, glue, stretch, anneal, weld, and rivet. They can laminate an airplane propeller in minutes compared to hours required by ordinary heat and pressure methods. They can dry green-sand foundry molds. Sheets of plastic can be joined by a new type of sewing machine utilizing radio-frequency waves instead of thread. Radio high-frequency technical furnaces are a postwar prospect. The possibilities for sensitive control devices through the application of electronics are many and varied.

A General Electric engineer recently stated that there are more than 40 portable million-volt X-ray units available in industrial plants making war materials. A year ago there was only one such unit in industry. Accelerated application of X rays to industrial inspection needs for welds, large castings, examination of production equipment to keep it operating or to forestall serious breakdown is something to ponder over, since there is the possibility of its varied application through the availability of equipment.

A new device termed the "Cyclograph" uses electronics to detect not only metal but wood and objects of varying density in packages passing along a moving belt.

The X ray is used for sorting as well as spotting defects. Electronic applications now fill bottles to the proper level, control high-speed wrapping of packages, count traffic, aid in prospecting for ore and oil, inspect razor blades, adjust motor-car headlights, coat sandpaper, detect gas in tunnels, operate safety doors in mines, light stores and offices automatically, grade cigars, make facsimile reproduction of maps, fill toothpaste tubes, candle eggs, level elevators, analyze card records, control humidity and temperatures, determine weather days ahead of time, square lengthwise and crosswise threads in weaving, and measure metal-foil thickness to 1/100,000 in.

Colors are absolutely matched by an electronic color analyzer. The human eye can discern 10,000 tints of red, blues, greens, browns, and yellows. The electronic recording spectrophotometer separates 200,000 of these tints.

The microphotometer is almost uncanny in its ability to look into a sample from a furnace heat of molten metal and tell exactly what elements are present in the alloy, and in what quantity.

A recent advertisement of the Westinghouse Company states that when the United States turned, after Pearl Harbor, to electrolytic tin plate, as a means to conserve two thirds of the tin used in the hot-dip process, it was discovered that the coating was porous. Engineers in the Westinghouse research laboratory decided that the porous tin coating could be fused through the magic of electronics to give the tin plate the desired protective coating.

These scientists built a high-frequency coil, using radio-broadcasting oscillator tubes for their power source. Through this coil they passed electrolytic tin plate and the inductive heating effect melted the tin coating, refining it and giving it the necessary corrosion-resistant properties. The new Westinghouse tin-flowing process is now in actual commercial use turning out gleaming ribbons of tin plate at more than 500 fpm.

This is probably only a start in a new field applying electronics to electrolytic coatings and perhaps to other undeveloped coatings.

In emergencies, for example, as when a hurricane struck New England several years ago, an electronic "carrier current" permitted telephone conversation temporarily to pass through high-tension power lines.

Television, with projections in color, will probably develop after the war as a sizable postwar industry. The application of

television to training operators and salesmen and to other factory educational purposes appears intriguing.

No one knows what new fields of knowledge will be opened up by the new electron microscope capable of magnifying 150,000 times. That we will learn a lot more about the structures of materials; about chemicals, about disease and infections; about the effect of drugs and medicines; in fact about a host of other things, seems to be clear.

Electronics is fundamental, so keep your eyes on electronics and electronic developments. Its aid to mechanical engineering, because of the fact that so many operations can be completely controlled and made fully automatic, opens wide vistas in design. The possibility of its application to continuous inspection and similar problems seems promising.

Contemplate the wonders of modern machine tools, not only their precision, output, ease of control and adjustment, their speed and versatility but the fact that many are either semiautomatic or completely automatic. Machine-tool manufacturers, even in the face of wartime demands and pressures, have new wonders to bring forth at some future date. This industry which has produced in a current war year about seven times its peacetime peak volume, may be confronted with a revolution in the art of cutting metals similar to that which it faced a generation ago with the advent of high-speed tool steels. When specially designed carbide milling cutters operating at surface speed in excess of 900 feet per minute on steels can remove chips at feeds of 60 in. per min and exceed 225 in. per min feed on nonferrous metals with a cutter surface speed in excess of 10,000 fpm, the indications of some far-reaching important developments are apparent. Think what this is going to mean to engineers in tooling up again for new peacetime products.

New lubricants and coolants and lubrication coolant methods are being evolved and developed for war purposes. These will have a decided effect on designs of future products.

A new glass has been developed for plug ring, slot, snap, and profile gages for inspection operations. In many respects these gages are better than those made from metals. For one thing they will not rust or corrode. Here is a decidedly new application of glass, born of necessity to conserve critical material. A glass has been developed which contains no sand and has unique light-bending properties.

A process has been developed for making bearings for motors and generators of babbitt metal without tin.

Reflectors for fluorescent lamps are now made of a heated pressed-wood fiber. These reflectors are lighter in weight and have a slightly higher light-reflection efficiency.

Consider the development in the art of welding. Such rapid strides have been made in welding ships, tanks, gun mounts, engine frames, and the like that the application of the art, technique, and methods to commercial articles on a large scale may prove quite revolutionary. Welding may make possible food-processing equipment at the site of harvesting, for example.

A recent outstanding advance in electric power transmission, in which many mechanical engineers are interested, is brought to life in an issue of the *Industrial Bulletin* of Arthur D. Little, Inc., Cambridge, Mass. This is the use of nitrogen gas as insulation for high-voltage cables underground. Underground cables have presented increasing problems as higher and higher voltages have been required. The use of nitrogen cables has eliminated many maintenance problems and permits voltages comparable with those in overhead transmission. Gas cable installations have been increasing here and abroad and now there are approximately 25 conductor-miles of transmission of these conductor cables.

Wireless transmission of power may be nearer than we think, perhaps as a by-product of other developments.

The development in powder metallurgy is something for engineers to watch. The production of precision pieces by this process without further machining in many instances is quite intriguing. Only recently an accurate 60-lb bronze bearing was produced in one minute. It seems to me this art is in its infancy, and that its application probably can be extended in many directions.

The war has forced the production of artificial spices. Imitation cinnamon is now being produced after several months of research and experimental work.

From the development in chemistry, in plastics, in metallurgy, in electronics, and from the derivatives of petroleum and natural gas, we can expect, under a free-enterprise system, whole new industries to rise.

I have never had any patience with the idea that the industrialization of the United States is complete, that there were no new opportunities to explore and pioneer. I have lived long enough to see the telephone, the electric light, the electric train, radio, airplane, automobile, steam turbine, and a host of other things developed, perfected, and put to man's daily use. No, the United States is not finished, its economy will not be static, so long as free men and women are at liberty to choose what they want to do, to back their ideas, and to develop. But mark these words, the United States will be finished as a progressive dominant nation if we regiment and unduly restrict free enterprise—free effort; if we block the path of the boy from across the tracks to attain through his own efforts the highest position in the land.

On the contrary it is my deep-rooted belief that after the war the world will be on the threshold of the most marvelous period of expansion and growth in all history, if we have the courage, imagination, and common sense to guide latent forces.

From each new scientific discovery and invention will spring new industries requiring new capital, engineering, new machines and equipment, and additional workers to produce, service, and distribute them.

The rapid development of the radio, the airplane, and the dye and chemical industry in our country is attributable to World War I. So it is reasonable to assume that new industries will evolve from this war—television, synthetic rubber, low-cost foolproof individual planes, new drugs, and the like.

We cannot turn back from the new developments of scientific research, even if we want to. Their impact on engineering design and application will be tremendous and we engineers should be prepared for it. Our old preconceived ideas will be jolted, to say the least. We need to be alert, receptive, open-minded, tolerant, and imaginative. These are true engineers' characteristics with which to help absorb the impact of these new ideas, new developments, new things.

I look upon these new developments as rare opportunities to progress, to develop, to raise the standard of living. True, they will necessitate changes. They will upset old methods. They will disrupt some industries and render some products obsolete. But that way lies the path of progress. It has ever been the American habit to search for and want something better. No nation yet has been able to satisfy the needs of its nationals, let alone their wants. So let us accept these developments as a means for engineers to aid in supplying one of the bases for a better life. The only way it can be provided is by work, greater production, and thereby the creation of wealth. We have proved we can do it in wartime. Let us turn our talents and the application of these new developments to the peacetime economy when it is time, but we should plan for it in advance of that time.

To A.S.M.E. Members:

THE COUNCIL REPORTS FOR 1943

PRESIDENT Coes in his address at the Los Angeles meeting, June 14–17, 1943, said: "Management, broadly, is the development and co-ordination of people and not the direction of things." Successful management requires "planning what we want people to do" and "operational control . . . . so as to require people to work according to the plan. . . ." "There must be

(*a*) a philosophy of management,
(*b*) a sound organization structure,
(*c*) good supervision,

if production of the desired quality and quantity is to be attained."

In the midst of the year, the problems of war industry, and therefore of mechanical engineers, shifted from design for production to production itself with increased emphasis on greater production per man-hour. This far cry from the wails of the thirties about technological unemployment and the evils of labor-saving machinery has placed a greater responsibility on leaders in production and management to develop the methods, the incentives, and the leadership to secure the last ounce of output per unit of man and machine input. It was fitting, therefore, that the Society take again its place of leadership in the discussion of management problems as exemplified by the quotation from the President with which this report is prefaced.

THE SOCIETY AND THE WAR

Members of the Society may take pride in the organized activities of the Society in direct support of the war effort. These include the sponsorship, with other societies, of some 28 production clinics held in important industrial centers for the purpose of stimulating a rapid interchange of experience in fabricating war materials. A special research committee conducted useful investigations in the forging of steel shells for the Ordnance Department, which are to be continued during the coming year in forging steel bomb bodies. A special Manufacturing Engineering Committee was set up to support the work of the Office of Production Research and Development of the War Production Board. An aggressive program of industrial conservation was conducted. These, and the normal activities of the members, resulted in the devotion of a large proportion of the space in the publications of the Society to the investigations and reports of outstanding contributions for improving war-production effort.

The intense industrial effort during wartime and its demands upon the engineering profession have directed attention to the importance of improved organization of the profession for its increased effectiveness. Some important advances have been made in working together with other engineering societies.

The Joint Committee on Inter-American Engineering Co-operation is bringing the engineering societies of Latin America into closer relations with those of the United States. The Joint Conference of Presidents and Secretaries of five national engineering societies is discovering that most of its problems relate to professional welfare. The Engineers' Council for Professional Development is a professional outpost, scouring and measuring professional objectives. The Consultative Committee on Engineering is another attempt to present a more united front in dealing with the most effective use of engineers in the war program. The Model Law for the registration of engineers is the product of representatives of those engineering societies which are interested.

This Society supports each of these attempts to express a more unified professional point of view and participates in some 27 other activities in co-operation with other societies.

THE ORGANIZATION OF THE SOCIETY

The effective co-ordination of 423 activities of divisions, sections, committees, and joint bodies requires careful managerial control.

The Society operations are supervised by the Council and its Executive Committee, by 16 Standing Committees, 20 special committees, 32 joint committees or boards, 19 professional divisions, 68 local sections, 120 student branches, 18 research committees and 7 joint research committees, 30 standardization committees, 19 power test, boiler, and safety committees. The Society participates in 84 joint committees which represent the co-operation of 31 societies.

Committee reports are arranged under three divisions: namely, I Promoting the Art and Science of Mechanical Engineering; II The Engineering Profession; III Administration of the Society.

I PROMOTING THE ART AND SCIENCE OF MECHANICAL ENGINEERING

MEETINGS AND PROGRAMS

The programs of meetings have been dominated by the demands of war on mechanical engineering. That the attendance has been so surprisingly large is a tribute to the value of the programs and the loyalty of the membership.

TABLE 1 ANALYSIS OF PROGRAMS OF NATIONAL MEETINGS, PROFESSIONAL DIVISIONS

Meetings	Papers and addresses	Sessions	Authors	Total registered
Society:				
Fall, Rochester, N. Y., Oct. 12–14, 1942.	29	14	36	530
Annual, New York, Nov. 30–Dec. 4, 1942	125	48	198	3335
Spring, Davenport, Apr. 26–28, 1943	50	21	77	471
Semi-Annual, Los Angeles, June 14–17, 1943	50	23	75	1282
Professional Divisions:				
A.S.M.E.-A.I.M.E. Joint Fuels & Coal Conference, Sept. 30–Oct. 1, 1942	10	4	10	300
Wood Industries Meeting in connection with Davenport Spring Meeting, Apr. 26–28, 1943	10	3	10	*
Oil and Gas Power, June 14–16, Baltimore	7	4	7	300
Applied Mechanics, Pittsburgh, June 25–26, 1943	10	3	15	125
Total	291	120	428	6343
Corresponding totals for 1941–1942	316	125	438	5691

* Included in the Davenport figure 471.

Justification for holding the National Meetings as usual has been clearly demonstrated by an increase in attendance of over fifty per cent at meetings held the last year, particularly the

Semi-Annual Meeting at Los Angeles where 1282 were registered.

As the Annual Meeting has now outgrown the capacity of the Hotel Astor the Committee was fortunate in securing the facilities of the Hotel Pennsylvania for the 1943 Annual Meeting.

The attendance at recent society meetings has been as follows:

Prewar	Spring	Semi-Annual	Fall	Annual
1940	Worcester, 520	Milwaukee, 638	Spokane, 277	New York, 2488
1941	Atlanta, 510	Kansas City, 506	Louisville, 345	New York, 2937
War				
1942	Houston, 677	Cleveland, 820	Rochester, 530	New York, 3335
1943	Davenport, 471	Los Angeles, 1282	Toronto, 765	New York, 4453

PUBLICATIONS

A Subcommittee on the Development of MECHANICAL ENGINEERING recommended a program of expansion and improvement of service to members which will require additional editorial assistance. The Council generously increased the appropriation for salaries to provide this assistance.

Need for paper conservation has led the Committee to adopt a smaller page size for MECHANICAL ENGINEERING and lighter-weight paper for cover and text pages.

The editorial staff has referred doubtful papers to the War Department for clearance before publication. Export of publications was denied by the Bureau of Economic Warfare in several cases, but copies of publications are being held for distribution to members after the war.

President Coes' contributions to the "President's Page" in MECHANICAL ENGINEERING have been favorably received.

Increased appropriations for Transactions have permitted 64-page, instead of 48-page, issues of the *Journal of Applied Mechanics*.

The Membership List will be issued in 1944, probably in early summer.

The regretted death of George B. Karelitz led to the appointment of R. F. Gagg to fill his unexpired term, but Mr. Gagg's nomination to the Council will rob the Committee of his valued services. Frank L. Bradley was appointed to fill the unexpired term of A. R. Stevenson, Jr., who was elected to the Council in 1942.

PROFESSIONAL DIVISIONS

The Professional Divisions, although working under conditions of stress, have made considerable progress during 1942–1943. The Committee on Industrial Instruments and Regulators of the Process Industries Division has been changed to the status of a Division and the new executive committee is proceeding to draft by-laws.

Through the special efforts of Dr. J. E. Younger, as secretary of the Aviation Division, and Prof. C. L. Tutt, Jr., as staff assistant to the Production Engineering Division, activities in these areas have been considerably accelerated.

Dr. Younger made three trips to Los Angeles to line up the program for the Semi-Annual Meeting which proved to be an outstanding success.

When meetings were held where papers would not be available in preprint form, the round-table and discussion types of programs have proved quite successful. A Manual for this type of meeting has been made available and is printed in the July, 1943, issue of MECHANICAL ENGINEERING. Although difficult to get most authors to prepare their papers 90 days in advance of the meetings in order to preprint them, their value to members and guests seems to have been increased as indicated by the larger attendance at meetings. Even travel difficulties did not seem to deter attendance at meetings because of the great need for exchange and pooling of information.

A need to reorganize the activities of the Petroleum Division brought about a special meeting of executives of the oil companies with the Standing Committee to discuss ways and means for the A.S.M.E. to contribute its knowledge on the subject where it could prove most helpful. One of the outgrowths of this meeting was the inclusion of three Petroleum Division sessions at the Semi-Annual Meeting at Los Angeles to which President Coes invited persons connected with the petroleum industry. The Standing Committee has invited members of Executive Committees of Divisions to sit with them and discuss any particular problems which may need clarification.

The Graphic Arts Division is to be considered inactive for the duration of the war, but its list of members will remain intact until there is a revival of activities.

A member of the Society brought to the attention of the Standing Committee the need for a Design Group. In order to ascertain whether this program would interest many of the members, several sessions were arranged for the 1943 Annual Meeting which should give an indication of the demand for such a Group.

A liaison member for each Standing Committee on Local Sections and Professional Divisions was appointed early in the year. Their attendance at the committee meetings has been noticeably helpful in producing closer co-operation of the two committees.

In addition to those meetings mentioned under Meetings and Programs the Divisions participated in the 1942 Annual Meeting at New York, the Spring Meeting at Davenport, and the Semi-Annual Meeting at Los Angeles.

LOCAL SECTIONS

The major recommendations of the 1942 Group Conferences were:

That a formula be devised for payment of delegates' mileage that will assure payment of "bare actual cost" of attendance at Group and Regional Conferences.

That the practice of routing speakers to meetings of Local Sections be increased in scope.

That the various Local Sections should consider the desirability of forming advisory committees as a joint activity with other local engineering groups to form opinions on questions of public and civic interest of an engineering nature.

That a suitable citation be prepared by the Society and awarded by the Sections for meritorious work in the Society or civil affairs connected with engineering.

That a mechanism be designed for bringing before the Sections, Regional Conferences, and Group Conferences material of importance to the Society and its membership for discussion in the order of business.

That the number of meetings of the Society be limited to the minimum number which will provide the greatest aid to the war effort.

That an aggressive National Membership committee be appointed.

That the Committee on Economic Status of the Engineer should adopt an effective long-time program toward the objective of "bettering the economic status of the engineer, with especial reference to the young engineer."

That the participation and leadership of Local Sections in the conduct of War Production Clinics be endorsed and encouraged.

The Local Sections co-operated in the following National Meetings:

Tri-Cities Section, Spring Meeting at Davenport, Iowa, April 26–28

Southern California Section, Semi-Annual Meeting, Los Angeles, June 14–17

Ontario Section, Joint Meeting with The Engineering Institute of Canada, Toronto, Sept. 30–Oct. 2
Metropolitan Section, Annual Meeting in New York, Nov. 29–Dec. 3
Baltimore Section, Oil and Gas Power Division, Baltimore, June 14–16
Pittsburgh Section, Applied Mechanics Meeting, Pittsburgh, June 25–26.

It is noticeable that more and more the meetings of the Local Sections are concerned with subjects that tend to reflect the desire of the membership to assist in the solution of production problems. The Committee feels that in this attitude the Sections of the Society are making a contribution to the war effort.

BOARD OF HONORS AND AWARDS

During the year the following honors were awarded at the Annual Meeting in New York:

Honorary Membership	WILLIAM L. BATT WILLIS H. CARRIER CHARLES E. FERRIS JEROME C. HUNSAKER HARRY R. RICARDO
A.S.M.E. Medal	ERVIN G. BAILEY
Holley Medal	ERNEST O. LAWRENCE
Worcester Reed Warner Medal	FRED H. COLVIN
Melville Medal	J. KENNETH SALISBURY
Pi Tau Sigma Medal Award	JOHN T. RETTALIATA
Junior Award	WINSTON M. DUDLEY
Charles T. Main Award	BERNARD J. ISABELLA
Postgraduate Student Award	ARTHUR W. McCLURE
Undergraduate Student Award	JOSEPH P. LAIRD

The presentation of honorary memberships and medals was made at the Annual Dinner, the Postgraduate Student Award, the Undergraduate Student Award, and Charles T. Main Award at the Student-Council Luncheon.

RELATIONS WITH COLLEGES

In arranging for the usual Student Branch Conferences, account was taken of the difficulties in transportation by automobile.

Instead of the usual 10 such conferences, provision was made for 18 one-day sessions of which 16 were held and 2 were canceled because of the travel required to attend them. Each conference was attended by a member of the committee and by a representative of the president.

The dues of Student Branch members were changed to a six-month membership for $2.00, or a twelve-month membership for $3.00.

The Committee voted to admit to student membership those in the fourth term or beyond in the Specialized Army Training Program or who are in the third semester or higher of the Navy Program.

Civilian student registrations are still fairly large and Selective Service has so far ruled that undergraduates are eligible for deferment if they expect to be graduated by July 1, 1945.

EDUCATION AND TRAINING FOR THE INDUSTRIES

At the Annual Meeting, the Committee showed a moving picture of the Sikorsky helicopter which was followed by an address by the inventor and a discussion of "Ingenuity." A second session was devoted to a panel discussion of how to discover originality and to develop resourcefulness. A third session dealt with the ESMWT and similar training programs.

At the Spring Meeting in Davenport, the committee provided two programs devoted to war training.

LIBRARY

The Engineering Societies Library has been unusually busy in providing technical information to those engaged in war work.

In the nine months from October, 1942, to June, 1943, 27,653 photostats have been ordered by 817 borrowers.

The Library has been full of readers every day and numerous inquiries, largely dealing with the war, have been received, and answered, from persons as far off as Australia.

During the past year the Director of the Library has acted as consultant to the U. S. Army who is setting up a Library.

Your Library Committee is pleased to report that the Engineering Societies Library continues to maintain a very high standard of service to the Engineering Societies.

RESEARCH

The Research Committee provided 11 technical sessions and papers for other programs of the A.S.M.E. and other Societies.

The Committee co-operated with the Fuels, Power, and Heat Transfer Divisions and with other research committees.

New projects proposed by the Oil and Gas Power Division are being organized.

At the request of the U. S. Army Ordnance Department a new research on the manufacture of demolition bombs is under way with promising results.

The study of Fluid Meters, Strength of Gear Teeth, Cutting Metals, Mechanical Springs, Boiler Feedwater, and many other subjects is continuing in spite of difficulties created by the war.

STANDARDIZATION

During the year 11 standards developed by sectional committees, functioning under the administrative sponsorship of the A.S.M.E., were completed and presented to the American Standards Association for approval either as new American Standards, or revisions of existing standards. The list of these standards in the order in which they were completed during the past fiscal year follows:

Markings for Grinding Wheels, B5
Engineering and Scientific Graphs for Publications, Z15
Letter Symbols for Heat and Thermodynamics (revision), Z10
Air Gaps and Backflow Preventers in Plumbing Systems, A40
Machine Tapers, Self-Holding and Steep Taper Series (revision), B5
Shafting and Stock Keys (revision), B17
Ferrous Plugs, Bushings, and Locknuts, With Pipe Threads, B16
Circular and Dovetail Forming Tool Blanks and Associated Mounting and Clamping Elements for Holders Used on Automatic Screw Machines (revision), B5
Tool Shanks and Tool Posts (revision), B5
Letter Symbols for Gear Engineering, B6
Spindle Noses and Arbors for Milling Machines, B5

The A.S.A. has given its approval to the first 4 of these standards and it is expected that early in the new fiscal year the other 7 will be approved and made available as American Standards in final pamphlet form.

In addition the proposed Supplement to the American Standard for Socket Set Screws and Socket Head Cap Screws (B18.3-1936) has been submitted to the sponsor bodies for approval and transmission to the A.S.A.

The proposed American Standard for Spring Lock Washers, B27, and a revised draft of the proposed revision of the American Standard for Cast-Iron Pipe Flanges and Flanged Fittings, Class 250, B16, have been submitted to the initiating sectional committees for vote on approval by letter ballot.

During the past year good progress was made toward the complete revision of the standards for drawings and slotted-head screws, and toward the completion of the new standard for tolerances and inspection of gears.

This year also marked the completion by the initiating subgroup of the first tentative draft of the 15 sections of the proposed American Standard Plumbing Code.

Two important administrative technical committees were formed within the year. One is a subcommittee of Sectional Committee B31 on a Code for Pressure Piping. Its function is indicated by its name, Subcommittee on "Scope and Intent" and it will handle, in a systematic manner, inquiries received concerning the scope and intent of the various sections of the Code. The second is the Joint Conference Committee on Piping Codes and Standards whose membership consists of officially appointed representatives of the Boiler Code Committee, Sectional Committee B16 on Pipe Flanges and Fittings, and Sectional Committee B31 on Code for Pressure Piping. The organization meeting of the latter was held in June and a good start was made toward co-ordinating the overlapping requirements for piping and pipe fittings in the standards and codes involved.

In addition to the foregoing on September 30 there were 23 standards reports in the various stages of development from the preparation of the original manuscript to the submission of the report to the American Standards Association for approval. The number of committees engaged in this work under the auspices of the A.S.M.E. during the year was 294; the number of A.S.M.E. members, 364; nonmembers, 972; and the number of co-operating organizations, 224.

Last fall at the request of the Conservation Division of the War Production Board the Society donated the services of Clifford B. LePage, secretary of the Standardization Committee, to the division on the dollar-a-year basis. Since the close of the Annual Meeting he has given three days a week to this part of the war effort.

BOARD ON TECHNOLOGY

The Board on Technology endorsed the request of the Applied Mechanics Division that the *Journal of Applied Mechanics* be expanded.

The Board also favored the suggestion that a series of A.S.M.E. lectures, similar to those of Sigma Xi, be established. The chairmen of the Local Sections and Professional Divisions Standing Committees have given considerable attention to developing a practicable program and report progress.

BOILER CODE

During the past year the Boiler Code Committee has been engaged largely in extending the provisions of its Codes to authorize the use of materials not before recognized in the Code and to provide for new methods of construction. Seven new material specifications were added to the Code, and all recently issued A.S.T.M. Emergency Alternate Provisions affecting present Code specifications were accepted by the Committee. Special rulings were issued to provide for the fabrication of vessels of aluminum alloy to Specifications S-39, and for the fabrication of steel plate covers for pressure vessels.

The temperature limitations for Par. U-69 vessels have been removed, while the pressure limit has been increased to 600 psi.

CONSULTING PRACTICE

The Committee on Consulting Practice during the year reviewed the Manual of Practice, approved by the Council of the Society on December 2, 1940, and voted unanimously that no revisions were indicated at present. An additional printing of this manual has been authorized by the Society.

In conformity with resolution adopted at the open forum on Consulting Engineering Problems held at the Annual Meeting at New York in December, 1942, recommendations have been sent to the Executive Committee of Council proposing the expansion of the Committee on Consulting Practice into a Consulting Engineering Professional Group and outlining its aims and purposes.

DEPRECIATION

It is a generally admitted fact that the depreciation problem will become more important during the period immediately following the war than ever before, when industry and government will be faced with many serious problems which are directly affected by the methods that are employed in handling depreciation. These include many problems connected with reconversion to peacetime production, valuation of war-built plants to decide whether they can economically be used for peacetime production, and, perhaps most important of all, the amount of depreciation which should be charged against production in determining profits subject to excess-profits taxes.

In spite of the generally admitted fact that industry should begin now to make those engineering studies which are a prerequisite to any successful solution of the problems mentioned, little is actually being done at present because of industry's almost complete present preoccupation with the problem of securing the greatest amount of war production.

ECONOMIC STATUS OF THE ENGINEER

In order at least indirectly to improve the economic status of members, especially of juniors, the Committee proposes that local sections undertake special activity on behalf of junior members such as organization of junior groups in the sections; organization of committees to foster these groups; counseling service by members for the benefit of individual juniors confronted by economic difficulties; discussion of reports and papers on economic questions by junior groups; discussion of outstanding papers on professional standing in junior groups; increased attendance by juniors at annual and other meetings of the Society; and identification of young engineers as such in large industrial organizations.

The Committee plans to co-operate with the Detroit Section in an investigation of immediate and direct economic and occupational problems confronting junior members. Such a project seems more feasible than certain others which the Committee has proposed.

DUES-EXEMPT MEMBERS

The Committee has carried on its usual activities throughout the year whereby (1) "Old Guard" prizes were awarded at 13 Student Conferences; (2) the Student and Charles T. Main prize winners were invited to the Annual Meeting in New York as its guests, with all expenses paid; (3) representatives of Student Branches were invited to be its guests at the banquets held during the national meetings of the Society. Letters of appreciation from the recipients give evidence that this activity is very much worth while.

It is with deep regret that the Committee records the death, on December 13, 1942, of Harte Cooke, chairman of the Committee since it was organized in 1937.

ENGINEERS' CIVIC RESPONSIBILITIES

The efforts of this committee have been almost entirely directed to stimulating a greater interest in responsible citizenship among the student members of the Society. Conditions in our engineering colleges thus far this year have been such that very little has been accomplished. The Committee has been enlarged and is planning on carrying the work forward as aggressively as conditions will permit.

FREEMAN FUND

The Freeman Fund Committee has undertaken no new activities during the year and therefore has no report to present other than to state that there is evidence of continued interest in the publications on "Hydraulic Structures" and "Experiments Upon the Flow of Water in Pipes and Pipe Fittings Performed in 1892 by John R. Freeman."

INDUSTRIAL CONSERVATION

Members of this Committee have worked with the Conservation Division of the War Production Board in the prepara-

tion of a book titled "Salvage Manual for Industry," to be published by the War Production Board on or before October, 1943.

A section of this book will consist of a revised and edited "Waste Materials Dictionary," originally published by The American Society of Mechanical Engineers in 1931. This will be Section 6 of the Manual and titled, "Waste Material Hints—a Classified List of Scrap Items."

Members of the Committee have co-operated with local offices of the War Production Board by acting as speakers at salvage meetings to stimulate uniform salvage procedure.

ENGINEERING ORGANIZATIONS WITHIN STATES

The previous report of the committee was reviewed at the Semi-Annual Meeting and was referred to the Group Conference for consideration at the 1943 Annual Meeting.

POWER TEST CODES

Progress has been made on the Specifications for Prime Movers of 10,000 Horse Power or More on Liquid Fuels, on revision of Stationary Steam Generating Units, on Coal Pulverizers, the revision of Steam Turbines, and other codes.

PROFESSIONAL CONDUCT

During the year the Committee on Professional Conduct has concerned itself with various proposals looking toward an agreement with other engineering societies on a joint code of ethics.

II THE ENGINEERING PROFESSION

This Society has traditionally supported a wide variety of joint activities in an attempt to further the broader development of the engineering profession.

Maximum effort by members and by the Society officers has been expended in supporting the war-production program. Many distinguished contributions cannot be mentioned for obvious reasons. The war is emphasizing the importance of the place of the engineer in society.

JOINT CONFERENCE OF PRESIDENTS AND SECRETARIES

The program to promote more intimate co-operation with Latin American engineers has progressed. Articles in American engineering journals are to be translated into Spanish and perhaps Portuguese.

The Consultative Committee on Engineering is designed to co-operate with the War Manpower Commission and problems of mutual interest have been studied.

ENGINEERS' COUNCIL FOR PROFESSIONAL DEVELOPMENT

This Council is a conference composed of three representatives selected by each of the following eight American engineering organizations, viz., the American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, The American Society of Mechanical Engineers, American Institute of Electrical Engineers, American Institute of Chemical Engineers, The Society for the Promotion of Engineering Education, National Council of State Boards of Engineering Examiners, and The Engineering Institute of Canada.

Five committees carry on activities:

The Committee on Student Selection and Guidance, besides continuing its counseling of high-school students who are interested in engineering, has recently joined with the S.P.E.E. and the Carnegie Foundation for the Advancement of Teaching for the purpose of continuing the measurement of aptitude for engineering.

The Committee on Engineering Schools visits institutions to determine their ability to give satisfactory instruction in engineering. Acceptable curricula are accredited which is generally accepted as decisive.

The Committee on Professional Training is preparing a Manual for Junior Engineers.

The Committee on Professional Recognition encourages the essentials of professional spirit.

A special committee on the Principles of Engineering Ethics has reported to the co-operating societies "Proposed Canons of Ethics for Engineers."

THE ENGINEERING FOUNDATION

The purpose of the Foundation is "the furtherance of research in science and engineering and the advancement in any other manner of the profession of engineering and the good of mankind."

During the past year 13 research projects have been carried on with funds provided by income from the Swasey endowment and contributions from industry and universities.

Of the investigations under way six are of special interest to The American Society of Mechanical Engineers. They are:

Critical-Pressure Steam Boilers, conducted at Purdue University, dealing with temperature distribution in tube walls subjected to high rates of steam input, corrosion of alloy steel by high-temperature steam, and new alloys.

Rolling of Steel conducted at Westinghouse Research Laboratories.

Fluid Meters, an extensive study which produced numerous valuable papers such as "Results of Tests on Volumeters for Liquid Hydrocarbons" and "Volumeter Practice in the Petroleum Industry."

Unsteady-Heat-Flow Investigations by Electrical Analogy, conducted at Columbia University, deals with transient heat flow in solids.

Furnace Performance Factors

The *Engineers' Council for Professional Development* has had the generous financial support of The Engineering Foundation in carrying on its research program in engineering education and professional ideals.

UNITED ENGINEERING TRUSTEES

There are three representatives chosen by each of the four Founder Societies to manage the building provided by Andrew Carnegie.

The growth of the societies and the demand for more space has created problems.

Income, depreciation, and plans for the future are being studied in order that the value of the property may be maintained.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

Dean Thorndike Saville, Mem. Am. Soc. C.E., chairman of Section M, Engineering, George A. Stetson, Mem. A.S.M.E., Secretary, and Dean W. R. Woolrich, Mem. A.S.M.E., prepared a program for the New York City meeting of the A.A.A.S. set for December 28, 1942, to Jan. 2, 1943. The program was built around aero-medicine and the aviation industry, and the dehydration of foods. The A.A.A.S. convention was canceled at the request of transportation authorities.

NATIONAL BUREAU OF ENGINEERING REGISTRATION

The purpose of the Bureau is, first, to act as a certifying agency in order to minimize the effort and expense of engineers whose practice requires registration in a number of different states. Second, it provides a clearing house for state authorities, employers, societies, and others, and a source for verified and authentic information regarding professional records of engineers.

Twenty-two states recognize National Bureau registration but it is not required by law. There are 530 certifications by the Bureau.

REGISTRATION OF ENGINEERS

The purpose of licensing and the registration of engineers is "to protect life, health, and property."

Forty-five states, Alaska, Hawaii, and Puerto Rico have such laws.

There is still lack of uniformity in the requirements for and the procedure in obtaining a license as a professional engineer. The Model Law, a product of the engineering societies, is designed to create uniformity in requirements.

A recent proposal (effective now in New York and Ohio) is that recent graduates in engineering be permitted to take the scientific examination and so become "Engineers in Training" and so be part way toward obtaining a license.

NATIONAL RESEARCH COUNCIL, DIVISION OF ENGINEERING AND INDUSTRIAL RESEARCH

The principal problems to the solution of which the division has contributed, are:

Commutation of d-c motors at high altitudes.

Heat transmission and insulation which is concerned with contracts for $1,500,000 per year of research.

Concrete ships and barges.

In addition there are the Industrial Research Institute, an organization of small laboratories, the Highway Research Board, Committee on Bibliographic Service to Central and South America, Joint Committee on Inter-American Engineering Co-operation, and Engineering and Scientific Co-operation with China.

INTER-AMERICAN ENGINEERING CO-OPERATION

Philip W. Henry, Secretary of the Joint Committee representing the Am. Soc. C.E., A.I.M.E., A.S.M.E., A.I.E.E., and the A.I.Ch.E., reports that 20 letters were sent to engineering societies in Central and South America.

The Committee has obtained some 70 technical articles and a grant of funds has been asked of the Inter-American Development Commission with which to obtain translations into Spanish (and perhaps Portuguese) for distribution to engineering societies of the 20 republics to the South.

III ADMINISTRATION

The following subjects deal with the operation of the Society and with the office of the Secretary.

MEMBERSHIP

Increasing pressure has been brought to bear on the Committee on Admissions to provide a grade intermediate between Junior and Member. The increasing number of young men who have attained positions of responsibility in the engineering field, particularly in aeronauties, and who are under age for Member is such as to support argument for an intermediate grade between Junior and Member. Accordingly a proposal that an intermediate technical grade be re-established was included in the report of the Committee on Admissions for discussion at the Local Sections Regional and Group Conferences in 1942. A report by that Group to Council resulted in a request by Council that the Committee on Admissions review further the entire scheme of membership grades and make suitable recommendations to Council at an early date.

A report was made to Council for consideration at the Semi-Annual Meeting in Los Angeles, Calif., June 14–17, 1943, recommending slight changes in the Member grade, in order to provide for the gradual step up from Junior Member through Member. A definition for the proposed new Associate Member grade was submitted. It was suggested that the name of the present Associate be changed to Affiliate without changing the definition, in order to avoid confusion which formerly existed between the Associate and Associate Member grades. These changes are now under consideration by the Committee and Council for further discussion at the 1943 Annual Meeting.

The Committee on Admissions held twelve regular monthly meetings during the fiscal year 1942–1943.

The following are the applications considered in the transaction of its work and a summary showing the action taken:

Applications pending, October 1, 1942	176
Applications received during fiscal year 1942–1943	2257
Total applications handled during the year 1942–1943	2433
Recommended for membership	2062
Transfers denied	12
Deferred	28
Withdrawn, incomplete, and canceled	12
Applications pending September 30, 1943	319
Total applications handled during the year 1942–1943	2433

The 2062 recommended for membership were divided into the following grades:

Transfers to Fellow	13
Members	354
Transfers to Member	80
Associates	22
Transfers to Associate	3
Juniors	293
Transfers from Student Member to Junior Member	1297
Total recommended	2062
Transfers	96
Total new members recommended	1966

MEMBERSHIP DEVELOPMENT

This committee was appointed to increase the membership among professional engineers of high standing and engineering executives who meet the requirements for admission.

MEMBERS IN MILITARY SERVICE

Last year the Council adopted a policy on the payment of dues by members in military service whereby those in good standing at the time of entrance into the armed services of any of the United Nations, on or subsequent to May 1, 1940, "shall have their dues canceled upon approved application, and they shall be carried on an 'Inactive List' in their proper present membership grades, unless advanced, until six months after they are mustered out of the service or are removed from the inactive list by action of the Council." This does not affect the date on which members would become permanently exempt from the payment of dues as provided in the Constitution. Those whose dues are canceled "shall have their names published in the list with the other members, but shall not be entitled to receive publications."

To date 444 members in the armed services have taken advantage of this policy.

CONSTITUTION AND BY-LAWS

The only change in the By-Laws which have been adopted during the year was made to Article B5, Par. 9, making the method of payment for Student Members conform to the wartime conditions, and an amendment to B-14, Par. 16, to permit easier payment of bills under present conditions.

The Council also approved in November, 1942, changes to Articles R-7 and R-15, which had to do with professional practice and with the election of directors, and which were to implement by-law changes which had been approved earlier.

ENGINEERING SOCIETIES PERSONNEL SERVICE

There are over 800 unfilled positions on the books of the five offices of the Personnel Service. Industry is seeking qualified engineers for the metal and machine-tool industries. Design engineers are in demand for product development. The service was on a self-sustaining basis for the first time in several years.

TABLE 2 CHANGES IN MEMBERSHIP

(September 30, 1942, to September 30, 1943)

	Membership		Increases			Decreases				Changes		
	Sept. 30, 1943	Sept. 30, 1942	Transferred to	Elected	Reinstated	Transferred from	Resigned	Dropped	Died	Increases	Decreases	Net Changes
Honorary Members	28	25	6	2					5	8	5	+ 3
Fellows	132	127	8	1	1			1	4	10	5	+ 5
Members	8454	8264	75	312	67	14	42	124	84	454	264	+190
Associates	204	203	1	14			2	4	8	15	14	+ 1
Junior (20)	1131	1053	138	52	23	37	27	68	3	213	135	+ 78
Junior (15)	958	883	284	44	32	162	21	101	1	360	285	+ 75
Junior (10)	6578	6058		1227	32	299	19	414	7	1259	739	+520
Total Membership	17485	16613	512	1652	155	512	111	712	112	2319	1447	+872

OFFICE OPERATION

The Society has had difficulty in maintaining qualified personnel and Society activities have been somewhat handicapped.

Government regulations have been studied and complied with.

The Committee has assisted in making plans for additions to the staff for the professional divisions, especially in the machine shop and process industries.

The leave of absence of the Secretary, Colonel C. E. Davies, was extended. The services of C. B. LePage, Assistant Secretary of the Society, in charge of technical committees, have been made available for part-time service in Washington to assist the Simplification Branch of the War Production Board.

BOARD OF REVIEW

The Board of Review held four meetings in the fiscal year ending September 30, 1943, and one letter ballot was taken. These resulted in 449 recommendations to the Executive Committee of the Council.

A favorable trend of several years has reduced recommendations for the cancellation of dues to the insignificant total of 3. The notable drop in resignations to 157 is encouraging. It is undoubtedly due to the war effort and the part the Society is playing through close collaboration with the War Production Board.

Reinstatements are below last year, presumably because of the drop in resignations.

The Board of Review is well satisfied with the policies it recommended to the Executive Committee of the Council six year ago, and under which it has been operating since. It recommends that these liberal policies be continued without change.

FINANCES

The complete report of the Finance Committee follows this report.

THE COUNCIL AND EXECUTIVE COMMITTEE

The Council met in New York in December, 1942, and in Los Angeles in June, 1943. It also met informally in Davenport, Ia., April, 1943, and representatives of the Council met with the Executive Committee at its meeting held in Toronto, Ont., Canada, October 2.

The Executive Committee met seven times during the year. At three of the meetings, the following committees and divisions were represented and their respective programs and activities were discussed:

Professional Divisions
Metals Engineering Division
Management Division
Materials Handling Division

The President visited 20 Local Sections and Student Branches. Other members of the Council also visited sections and branches in their respective areas.

COMMITTEE REPORTS

The complete reports of the committees of the Society and of its representatives on joint agencies are embodied in a pamphlet of 52 pages which is available upon request.

DEATHS

The Society lost, through death, two Past-Presidents—Charles T. Main and Conrad N. Lauer; three former members of the Council—Harte Cooke, W. J. Sando, and Percival Roberts, Jr.; five Honorary Members—E. J. Prindle, H. H. Vaughan, Aurel Stodola, James A. Seymour, and Albert Kingsbury; also, George B. Karelitz who was former chairman of the Committee on Professional Divisions, and A. L. Kimball, former chairman of the Committee on Meetings and Program.

A.S.M.E. FINANCE COMMITTEE REPORT, 1942-1943

THE Standing Committee on Finance submits the following report on Financial Operations of the Society for the year ending September 30, 1943.

The year's experience has been fortunate in that revenue from advertising has been the highest in many years while revenue from dues and other sources has been well maintained.

The year's operations have resulted in total income of $614,730 with expenses of $555,400, leaving a net income of $59,329. This compares with a total income of $527,002 with expenses of $503,830, leaving a net income of $23,171 for last year. The Net Addition to Surplus for the year is $66,307, making the total surplus to date $306,063. Thus a comfortable extension of surplus has been made possible in accordance with the policy adopted last year by which the Council on recommendation of the Finance Committee decided to build up surplus in the good years to cushion the impact of a decline in income on Society activities, inevitably to be expected from the next recession in business.

At the same time, the Finance Committee adopted the policy of strengthening the Society's portfolio of securities by investing in and converting to Governments, gradually getting rid of the weaker elements in the list, especially those likely to be most affected by a business recession. It is the purpose to invest and reinvest the funds of the Society so as to preserve capital and retain liquidity rather than to try for higher income.

As was said in last year's report, "The effort has been to give the financial side of the Society's operations the sort of thoughtful, forward-looking, and prudent consideration that any careful financier would want to see applied to an enterprise in which he has a stake."

The following tabulation indicates the changes in distribution of securities in the Society's portfolio over the last three years in accordance with the policies outlined above:

PER CENT DISTRIBUTION OF SOCIETY'S INVESTMENT PORTFOLIO

	1940–41	1941–42	1942–43
Real-estate mortages and certificates	51.29	24.94	12.85
Industrial stocks and bonds	35.22	27.12	15.72
Government bonds	13.49	47.94	71.43

The Addition to Surplus for the year of $66,307 is the amount remaining after charges as follows:

To Trust Funds to bring them back to their original values	$ 5,000
To rotative project fund	8,500
To retirement fund	20,000
	$33,500

Respectfully submitted,

G. L. KNIGHT, *Chairman*
J. L. KOPF, *Vice-Chairman*
K. W. JAPPE
J. J. SWAN
W. H. SAWYER
W. G. CHRISTY } *Council Representatives*
W. J. WOHLENBERG }
W. D. ENNIS, *Treasurer*

OPERATING SUMMARY

A Balance Sheet. Accountants' Certificate
B Comparative summary of income and expense
C Statement of surplus
D Statement of changes in funds
E Detailed cost of activities
F How the A.S.M.E. spent its 1942–1943 income.

The Balance Sheet, Exhibit A, of September 30, 1943, shows, on that date, that the Society owed:

(1) Current bills	$ 5,464.36
(2) Obligations for printing and distributing the 1944 Mechanical Catalog, bills for which have not been submitted	13,932.10
(3) Other obligations for which bills have not been submitted	2,965.92
(4) Unexpended appropriations for future services	26,144.55
(5) Special research and other committees which have collected funds for special purposes to be expended as needed	43,756.81
(6) Future services to members who have prepaid their dues	90,335.55
(7) Advertisers and subscribers to publications who have prepaid	4,039.40
	$186,638.69

To meet these debts the Society had:

(1) Cash in the bank	$106,656.33
(2) Accounts receivable	81,950.17
(3) Inventories of publications and supplies conservatively valued at	22,105.94
(4) Securities (at the lower of cost or approximate quoted market values)	281,860.21
(5) Prepaid insurance of	129.87
	$492,702.52

The difference between the value held by the Society of $492,702.52 and debts of $186,638.69 is the net worth of the Society on September 30, 1943 ..... $306,063.83

The Society had other liabilities:

(1) Trust funds amounting to		$123,006.24
against which the Society had the following assets:		
(a) Cash	$ 40,535.87	
(b) Notes receivable	1,050.16	
(c) Securities (at the lower of cost or approximate quoted market values)	81,420.21	
	$123,006.24	
(2) Property fund of		$531,790.37
with the following assets to support it:		
(a) Quarter interest in building	$498,448.48	
(b) Office furniture and fixtures (depreciated value)	33,339.89	
(c) Library books	1.00	
(d) Engineering Index, Inc.—Title and good will	1.00	
	$531,790.37	
(3) Employees' Retirement Fund of		$ 66,556.63
covered by:		
Cash	$ 22,366.08	
Securities (at approximate quoted market value)	44,190.55	
	$ 66,556.63	
(4) Rotative Project Fund of		$ 13,413.40
Cash	$ 13,413.40	

EXHIBIT A

BALANCE SHEET—SEPTEMBER 30, 1943

ASSETS

GENERAL FUND:			
Cash in banks and on hand			$ 106,656.33
Accounts receivable:			
Dues—current year	$ 15,854.46		
Dues—prior years	4,093.09		
	19,947.55		
Less—Reserve	19,947.55	.....	
Publications and advertising	$ 78,346.68		
Less—Reserve	2,064.52	$ 76,282.16	
Miscellaneous		5,668.01	81,950.17
Inventories, at cost or less:			
Publications completed		$ 9,730.23	
Publications in process		8,895.10	
		18,625.33	
Less—Reserve		2,178.06	
		$ 16,447.27	
Supplies		5,658.67	22,105.94
Securities:			
Real-estate mortage bonds and certificates (cost $69,775.49)	$ 36,394.77		
Less—Reserve provided from net profit on sales and portion of interest income	13,574.50	$ 22,820.27	
Railroad and industrial stocks and bonds (at the lower of cost or approximate quoted market values)		28,337.39	
United States of America Savings Bonds, Series F (at current redemption values)	$180,702.55		
United States of America Certificates of Indebtedness (at cost)	50,000.00	230,702.55	281,860.21
Prepaid insurance			129.87
			$ 492,702.52
ROTATIVE PROJECT FUND:			
Cash in banks			13,413.40
EMPLOYEES' RETIREMENT FUND:			
Cash in banks		$ 22,366.08	
Real-estate mortgage bond (cost $14,000)		9,050.00	
United States of America Savings Bonds, Series F (at current redemption values)		35,140.55	66,556.63
TRUST FUNDS:			
Cash in banks		$ 40,535.87	
Notes receivable (Major Toltz Fund)		1,050.16	
Securities (at lower of cost or approximate quoted market values):			
Stocks and bonds	$ 37,830.65		
Real-estate mortgage certificates	8,661.56		
United States of America Savings Bonds, Series F (at current redemption values)	34,928.00	81,420.21	123,006.24
PROPERTY FUND:			
One-fourth interest in real estate and other assets of United Engineering Trustees, Inc., exclusive of Trust Funds		$498,448.48	
Office furniture and fixtures (depreciated value)		33,339.89	
Library books		1.00	
Engineering Index, Inc.—Title and good will		1.00	531,790.37
			$1,227,469.16

LIABILITIES

GENERAL FUND:			
Accounts payable			$ 405.67
Federal income tax withheld from employees			5,058.69
Accrued liabilities and reserves:			
Estimated liability relating to Mechanical Catalog for 1943–1944	$13,932.10		
Other accrued liabilities (estimated)	2,965.92		
Reserve for unexpended appropriations	26,144.55		43,042.57
Unexpended balances of Custodian Funds			43,756.81
Deferred credits:			
Dues and initiation fees paid in advance	$90,335.55		
Prepaid subscriptions (estimated)	4,000.00		
Prepaid advertising	39.40		94,374.95
Surplus (Exhibit C)			306,063.83
			$ 492,702.52
ROTATIVE PROJECT FUND (Exhibit D)			13,413.40
EMPLOYEES' RETIREMENT FUND (Exhibit D)			66,556.63
TRUST FUNDS, including unexpended income (Exhibit D)			123,006.24
PROPERTY FUND			531,790.37
			$1,227,469.16

NOTE: Initiation and promotion fees receivable are not included in the above statement as they are taken up by the Society only as and when collected.

EXHIBIT B

COMPARATIVE SUMMARY OF INCOME, EXPENSES, AND APPROPRIATIONS

For the Two Years Ending September 30, 1943

	Year 1941–1942	Year 1942–1943
INCOME:		
Initiation and promotion fees (to surplus)	$ 11,565.35	$ 13,008.42
Membership dues*	$232,626.70	$241,594.17
Student dues	24,998.85	26,715.35
Interest and discount (net)	9,955.95	5,388.35
MECHANICAL ENGINEERING advertising	127,741.52	178,457.30
Mechanical Catalog advertising	57,062.86	68,517.82
Publication sales	74,016.63	91,474.82
Miscellaneous sales	2,601.06	1,684.79
Contributions—*Journal of Applied Mechanics*	1,100.00	500.00
Engineering Index, Inc.	.....	798.60
Registration fees	698.00	405.00
Sale of equipment	104.50	35.00
Membership list advertising	603.00	.....
TOTAL INCOME	$531,509.07	$615,571.20
EXPENSES AND APPROPRIATIONS:		
Expenses under committee supervision (including appropriation of $20,000 to Employees' Retirement Fund in 1942–1943 and $10,000 in 1941–1942)	$ 90,197.24	$103,047.30**
Publication expense	168,653.15	191,197.02
Office expense	244,980.23	261,155.97
Appropriation to reserve for mortgage investments—interest on mortgages and mortgage certificates in excess of 3% on the book value thereof for the six months ending March 31, 1943 and for the year 1941–1942	4,506.49	841.19
Total Expenses and Appropriations:	$ 508,337.11	$ 556,241.48
Excess of income over expenses and appropriations	$ 23,171.96	$ 59,329.72

* Membership dues have been stated on the basis of total cash received during the year.

** Includes assessment of $3,000 by United Engineering Trustees, Inc., for building operating deficit.

EXHIBIT C

STATEMENT OF SURPLUS

Year Ending September 30, 1943

BALANCE, SEPTEMBER 30, 1942		$239,756.83
ADD:		
Initiation and promotion fees collected		13,008.42*
Excess of income over expenses and appropriations for the year (Exhibit B)		59,329.72
Unexpended balances of prior years' appropriations		1,873.19
Net profit on sale of investments:		
Bonds and stocks	$2,416.93	
Real-estate mortgage certificates	1,922.56	
	$ 4,339.49	
Less—Appropriation to reserve for mortgage investments	951.45**	
		3,388.04
Adjustment of carrying value of bonds and stocks owned to the lower of cost or approximate quoted market value at September 30, 1943		2,207.63**
		$319,563.83
DEDUCT: APPROPRIATIONS TO:		
Rotative Project Fund	$8,500.00	
Trust Funds	5,000.00	
		13,500.00
BALANCE, SEPTEMBER 30, 1943		$306,063.83

* As it is the practice of the Society to take up initiation and promotion fees only as and when collected, the above statement does not include such fees receivable at September 30, 1943.

** The value at which the investments of the General Fund are carried is $49,161.70 below cost and $28,260.03 below their approximate aggregate quoted market value at September 30, 1943.

ACCOUNTANTS' CERTIFICATE

TO COUNCIL OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

We have examined the balance sheet of The American Society of Mechanical Engineers as of September 30, 1943, and the summary of income, expenses and appropriations and statements of surplus and changes in funds for the fiscal year ending that date. Our examination was made in accordance with generally accepted auditing standards applicable in the circumstances, and included such tests of the accounting records and other supporting evidence and such other procedures as we considered necessary.

In accordance with the practice followed by the Society in prior years, no effect has been given in the statements to accrued income on investments.

The membership dues are included in the income account of the current year on the basis of total cash received on account of that year and prior years and provision has been made for all dues uncollected at September 30, 1943.

In our opinion, the accompanying balance sheet and related summary of income and expenses and statements of surplus and changes in funds present fairly the position of The American Society of Mechanical Engineers at September 30, 1943, and the results of its operations for the fiscal year on the basis indicated in the foregoing paragraphs and the appended statements.

(Signed) PRICE, WATERHOUSE & CO.

New York, N. Y.
November 6, 1943

EXHIBIT D

STATEMENT OF CHANGES IN FUNDS

Year Ending September 30, 1943

ROTATIVE PROJECT FUND

BALANCE AT SEPTEMBER 30, 1942	$ 4,913.40
Appropriation from General Fund surplus	8,500.00
BALANCE AT SEPTEMBER 30, 1943	$ 13,413.40

EMPLOYEES' RETIREMENT FUND

BALANCE AT SEPTEMBER 30, 1942	$ 45,769.42
Add:	
Income from investments	760.20
Interest on savings-bank deposits	27.01
Appropriation from General Fund	20,000.00
BALANCE AT SEPTEMBER 30, 1943	$ 66,556.63

TRUST FUNDS

BALANCE AT SEPTEMBER 30, 1942		$108,851.77
Add:		
Income from investments		3,343.66
Interest on notes receivable		180.76
Interest on savings-bank deposits		52.13
Life memberships purchased		1,597.75
Acquisition of assets of Gantt Medal Fund		3,070.60
Net profit on sale of investments		1,469.52
Appropriation from General Fund surplus		5,000.00
Adjustment of carrying value of bonds and stocks owned to the lower of cost or approximate quoted market value at September 30, 1943		2,510.32*
		$126,076.51
Deduct:		
Expenditures for prize awards, etc.	$2,224.91	
Proportion of life-membership dues transferred to General Fund income	815.00	
Investment custodian fees	30.36	
		3,070.27
BALANCE AT SEPTEMBER 30, 1943		$123,006.24

* After giving effect to this adjustment, the carrying value of the Trust Fund securities is $9,072.31 below cost.

EXHIBIT E

DETAILED COST OF A.S.M.E. ACTIVITIES 1942–1943

(Approved by Finance Committee October 22, 1943)

Description	Expense under committee supervision	Printing and distribution expense	Office expense	Total cost 1942–43	Total cost 1941–42
Council	$ 5,500.00			$ 5,500.00	$ 4,600.00
Library	9,471.20			9,471.20	9,356.88
U.E.T. Deficit	3,000.00			3,000.00	
Engineers' Council for Professional Development	2,050.00			2,050.00	1,950.00
Finance Committee	108.00			108.00	108.00
Awards	1,100.00		$ 483.89	1,583.89	1,197.89
Nominating Committee	587.44			587.44	432.15
Local Sections	27,302.42		6,668.23	33,970.65	33,279.99
Meetings and Program	9,688.87		9,824.55	19,513.42	14,408.02
Professional Divisions	3,700.00		10,830.24	14,530.24	13,515.76
Admissions			8,883.06	8,883.06	7,696.38
Employment Service	500.01			500.01	2,000.00
Employment Reserve	1,500.00			1,500.00	
Student Branches	8,662.51	$ 6,362.47	4,880.57	19,905.55	17,619.25
Technical Committee	1,000.00		21,918.24	22,918.24	22,439.68
MECHANICAL ENGINEERING Text Pages		29,253.43	11,708.62	40.962.05	47,737.32
Transactions and *Journal of Applied Mechanics*	93.30	37,457.09	13,213.63	50.764.02	49,691.82
Membership List		7,500.00		7,500.00	3,511.85
MECHANICAL ENGINEERING Advertising Pages		42,119.31	40,793.96	82,913.27	66,264.60
A.S.M.E. Mechanical Catalog		28,300.00	27,760.14	56,060.14	49,770.62
Publication Sales		40,204.72	11,493.95	51,698.67	41,504.42
Retirement Fund	22,700.00			22,700.00	12,700.00
Professional Services	1,448.50			1,448.50	1,248.50
Membership Development	4,500.00			4,500.00	3,000.00
Organization Charts	135.05			135.05	45.71
Secretary's Office			20,447.51	20,447.51	20,116.67
Accounting			18,783.01	18,783.01	15,853.84
General Service			31,674.29	31,674.29	35,968.65
General Office			21,792.08	21,792.08	27,812.62
	$103,047.30	$191,197.02	$261,155.97	$555,400.29*	$503,830.62

* Does not include $841.19 (Exhibit B) as on the Society's books, it is charged directly against "Interest and Discount" income.

How the A.S.M.E. Spent Its Income in 1942-1943

EXHIBIT F

Dues Income: $241,594.17—$13.82 per Member.

The principal item of income is the dues paid by the members. Juniors pay $10, $15, or $20 depending upon their age; Members pay $20, Fellows, $25, except that those who have been on the rolls of the Society for 35 years or who have reached 70 and have been members 30 years are carried without dues. On September 30 the Society had 17,485 members on its rolls and during the year $241,594.17 was collected in dues. The per-member dues income is therefore $13.82.

The publications of the Society are MECHANICAL ENGINEERING, Transactions, including the *Journal of Applied Mechanics*, the Membership List, and the A.S.M.E. Mechanical Catalog and Directory. Income is obtained from advertising in Mechanical Engineering and in the Catalog. Contributions have been received for the *Journal of Applied Mechanics*. An income and expense statement for the publications appears below:

PUBLICATIONS

	Direct expense	Income
MECHANICAL ENGINEERING	$123,875.32	$178,457.30[a]
Transactions (including *Journal of Applied Mechanics* and Membership List)	58,264.02	500.00
A.S.M.E. Mechanical Catalog	56,060.14	68,517.82
Publications sold	51,698.67	91,474.82
	$289,898.15	$338,949.94
Indirect Expense	51,000.36	
	$340,898.51	
Less income	338,949.94	
Net cost of publications	$ 1,948.57	
Total expense of publications per member	19.50	
Publication income per member	19.39	
Net expense per member	$ .11	

[a] No allowance is included for what might be considered as A.S.M.E. member subscription to MECHANICAL ENGINEERING or Transactions. The net expense of $.11 may be regarded as the amount of these subscriptions.

Technical Committee Work: Net Expense $27,951.76—$1.60 per Member.

The Society has nearly two hundred technical committees engaged in the work on research, establishing power test codes, preparing the boiler code, and preparing standards and safety codes. The work of these committees is supported by direct staff expense which in 1942–1943 was $22,918.24. Adding to it indirect general expense of $5,033.52 gives a total expense of $27,951.76, which on a per-member basis is $1.60. The principal output of the technical committees is publications which are sold to members and to others. This figure of expense should therefore be considered in relation to the publication expense of the Society.

General Society Activities: Net Expense $88,814.11—$5.08 per Member.

The general activities of the Society include the holding of meetings, the operation of Local Sections, Professional Divisions, Student Branches, the administration of the procedure for admitting members to the Society, and the bestowal of awards. The Society receives income from Students for their membership in the Society. The following tabulation shows the net expense for this activity.

GENERAL SOCIETY ACTIVITY EXPENSES

	Direct expense	Income
Society Meetings	$ 19,513.42	$ 405.00
Local Sections	33,970.65	
Professional Divisions	14,530.24	
Student Branches	19,905.55	26,715.35
Admissions	8,883.06	
Awards	1,583.89	
	$ 98,386.81	$27,120.35
Indirect Expense	17,547.65	
	$115,934.46	
Less income	27,120.35	
Net cost of general Society activities	$ 88,814.11	
Total expense of general Society activities per member	6.63	
Income per member	1.55	
Net expense per member	$ 5.08	

Joint Activities: Net Expense $23,204.95—$1.33 per Member.

The Society also participates in a number of joint activities such as the Library, Engineers' Council for Professional Development, and the joint Employment Service. In addition to the payments to these joint bodies for these purposes a certain amount of general expense is allocated to these activities. The following tabulation gives the total of this expense.

JOINT ACTIVITIES

	Direct expense
Engineers' Council for Professional Development	$ 2,050.00
Engineering Societies Library	9,471.20
Employment Service	2,000.01
	$13,521.21
Indirect expense	9,683.74
Total cost of joint activities	$23,204.95
Expense per member	$ 1.33

Administration: Net Expense $40,345.06—$2.31 per Member.

In carrying out the Society activities, certain administrative services must be provided. These include the expense of the Council, the Nominating Committee, and the provision for auditing, legal, and other services. Certain general income is received. The following tabulation shows the amount of this expense and income.

General Society Administration

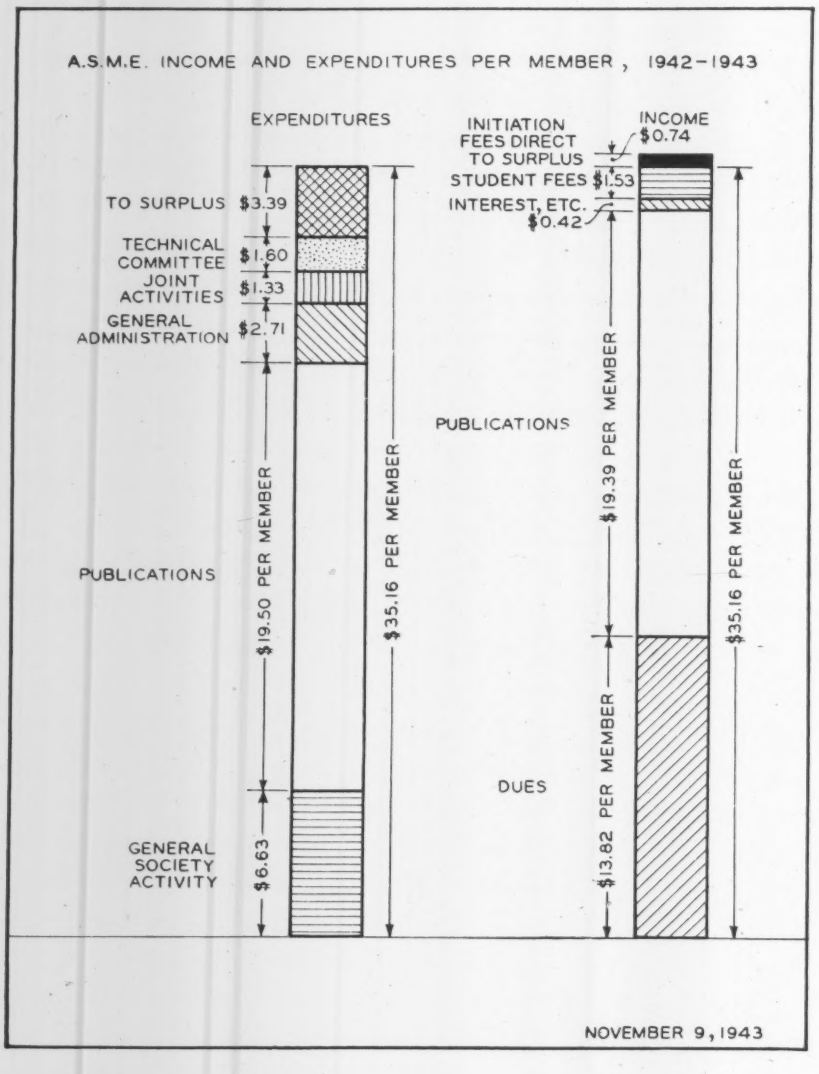
	Direct expense
Council	$ 5,500.00
Nominating Committee	587.44
Retirement Fund	22,700.00
Professional Services	1,448.50
Finance Committee	108.00
Membership Development	4,500.00
Organization Charts	135.05
United Engineering Trustees' Deficit	3,000.00
	$37,978.99
Indirect expense	9,431.62
	$47,410.61
Income from interest and miscellaneous	7,065.55
Net cost of general Society administration	$40,345.06
Expense per member	2.71
Income per member	.40
Net expense per member	2.31

Recapitulation

	Expenses	Income
Dues	$	$241,594.17
Publications	340,898.51	338,949.94
General Society Activity	115,934.46	27,120.35
Technical Committee Work	27,951.76	.....
General Society Administration	47,410.61	7,065.55
Joint Activities	23,204.95	.....
	$555,400.29	$614,730.01
Addition to surplus from operating income	59,329.72	
	$614,730.01	

Income and Expense per Member

	Expense per member	Income per member	Net expense per member
Dues	.....	$13.82	.....
Publications	$19.50	19.39	$ .11
General Society Activity	6.63	1.55	5.08
Technical Committee Work	1.60	.....	1.60
General Society Administration	2.71	.40	2.31
Joint Activities	1.33	.....	1.33
	$31.77	$35.16	
Addition to surplus from operating income	3.39		
	$35.16		



A.S.M.E. COUNCIL OPPOSES KILGORE BILL

[The Council of The American Society of Mechanical Engineers, at its meeting in New York, N. Y., Nov. 28–29, 1943, approved a statement prepared by a special committee appointed to study the Kilgore Bill (S.702) and transmitted the statement to MECHANICAL ENGINEERING for publication. Senator Kilgore has been notified of the Council's action and a copy of the statement has been sent to him. The statement follows.—EDITOR]

THE Kilgore Bill (S.702) was introduced in the United States Senate by Senator Harley M. Kilgore of West Virginia in February, 1943. It is now in the hands of the Senate Committee on Military Affairs. A similar bill (H.R. 2100) was introduced in the House of Representatives. The purpose of these bills, according to the language of S.702, to which this discussion will be confined, is "to mobilize the scientific and technical resources of the Nation, to establish an Office of Scientific and Technical Mobilization, and for other purposes."

The following extracts from the bill are given in order that it may be understood:

DECLARATION OF POLICY

SECTION 1. The Congress hereby recognizes that the full development and application of the Nation's scientific and technical resources are necessary for the effective prosecution of the war and for peacetime progress and prosperity, and that serious impediments thereto consist in—

The unassembled and uncoordinated state of information concerning existing scientific and technical resources.

The lack of an adequate appraisal, and the unplanned and improvident training, development, and use of scientific and technical personnel, resources, and facilities in relation to the national need.

The consequent delay and ineffectiveness in meeting the urgent scientific and technical problems of the national defense and essential civilian needs.

The trend toward monopolized control of scientific and technical data and other resources with lack of access thereto in the public interest.

The absence of an effective Federal organization to promote and co-ordinate, in the national interest, scientific and technical developments.

PURPOSE

The purposes of this Act accordingly are:

(1) To appraise the current use of scientific and technical knowledge, facilities, and personnel, and to develop comprehensive national programs for the maximum use of science and technology in the national interest in periods of peace and war.

(2) To mobilize for the prosecution of the war all scientific and technical facilities and personnel.

(3) To facilitate after the war the transition of the national economy from the tasks of war to peacetime enterprise.

(4) To assemble, co-ordinate, and develop for use, in the public interest, all scientific and technical data and facilities; to facilitate access to scientific and technical literature and to aid and encourage the writing and publication thereof.

(5) To promote the full and speedy introduction of the most advanced and effective techniques—for the benefit of agriculture, manufacturing, distribution, transportation, communication, and other phases of productive activity; for economical and efficient Federal, State, and local government; and for the national defense and general welfare.

(6) To aid, encourage, and protect the research and enterprise of inventors, scientists, technicians, scientific and educational institutions, research laboratories, and Government establishments engaged in scientific and technical work, and to make their resultant discoveries and data more readily available, and without discrimination, to all sections of industry, agriculture, and the public, to aid the war effort and to promote full employment and higher standards of living after the war.

(7) To discover and develop substitutes for strategic and critical materials, and to promote the most beneficial use of agricultural, mineral, and other natural resources.

(8) To promote interest in scientific and technical education, and to provide for all qualified persons the means of scientific and technical training and employment.

(9) To provide guidance in scientific and technical matters to the President, the Congress, and all Federal, State, and local government agencies and establishments, and to contribute guidance and, in all proper cases, financial and other assistance to solution of the technical and scientific problems of industry, agriculture, and of any agency or individual inventor.

(10) To promote the maintenance and expansion of free enterprise by making available to smaller businesses the benefits of scientific advancement.

(11) To standardize, when in the public interest, scientific and technical designs, practices, and specifications.

Finally, to carry out these purposes, the bill would

(12) *Establish a national scientific and technical office* to assure maximum co-operation and integration of the facilities and personnel of governmental and all private agencies, and to co-ordinate the activities of these facilities and personnel where necessary in the national interest.

Some slight condensations have been made in this statement of purposes, but essentially the wording follows the language of the bill. Throughout, it will have become evident, no qualifying clauses or phrases are used which tend to limit the scope of the purposes contemplated with respect to the future control of scientific and technical facilities and personnel. Indeed, these statements are replete with evidence of the purpose that the national government shall control the use of all scientific and technical research and laboratory facilities, irrespective of ownership, during war and peace.

Purpose (1) for instance, is, in part, to develop comprehensive programs for the use of science and technology "*in periods of peace and war.*"

Again, purpose (4) is to assemble, co-ordinate, and develop for use "*in the public interest,*" etc.

A particularly impressive example is purpose (5) to promote the introduction of the most advanced techniques for the benefit of a comprehensive list of economic functions, which is concluded with the phrase "and other phases of productive activity." Then follows the inclusion of governmental agencies, and, to clinch the matter, the paragraph concludes with "and for the national defense and *general welfare.*"

Purpose (6) is to aid research "in order to aid the war effort at the present time and *to promote full employment and higher standards of living after the war.*"

THE EFFECT ON INVENTION

The Office of Scientific and Technical Mobilization, headed by an Administrator, is vested with the duty and the necessary powers to perform 15 separate functions. The duties are closely related to the stated purposes of the act.

This is not to be an agency solely devoted to fostering and promoting the development and use of scientific and technical facilities and personnel by working through and stimulating other agencies. It is granted the power "*to initiate and carry out*" projects and programs of its own formulation. It may "*solicit and receive aid and support from any source* for the advancement of scientific and technical methods." To finance the

operations authorized by the act the Office has broad powers for acquiring and disposing of property, both real and personal, and may acquire, but not sell, patents, for the use of which it may grant nonexclusive licenses and collect royalties. It may make loans or grants. The bill carries an initial appropriation of $200,000,000 and the Administrator is authorized to organize corporations where they can be used for the more effective exercise of the powers of the Administrator and the Office.

To carry out purpose (4) to assemble, co-ordinate, and develop for use in the public interest all scientific and technical data and facilities, it is the duty of the office "to formulate and promote projects and programs" for development and use of laboratories and other technical facilities and "*when necessary, to initiate and carry out such projects.*"

It seems clear that therein lie the legal powers to control and gradually to socialize all scientific and technical research.

Purpose (6) is to aid, encourage, and protect the research and enterprise of inventors, and others, and "to make their resultant discoveries and data more readily available" to everybody. Section 7 tells how this is to be done. It vests in the Office "the exclusive right to use and the exclusive right to cause others to use" any invention in the discovery or development of which the Office or other governmental agency has rendered any assistance, either monetary or in the form of use of facilities or personnel. It is the duty of the Office to buy out any other interests in such discovery or invention. Here is the machinery for a governmental monopoly of invention.

In Section 2 "scientific and technical facilities" are defined as including "real property and personal property, tangible and intangible," used for scientific or technical purposes and further including "all methods, processes, procedures, techniques, designs, specifications, patents, inventions, and scientific or technical information, or knowledge of every description *used or intended to be used for scientific or technical purposes in research and development or in the production or supply of war or civilian goods or services.*" In the light of this definition, the duty of the Office (Section 4b) to formulate and promote as well as to initiate and carry out projects for the use of scientific and technical facilities carries the influence of the Office far down into the working processes of the production and service industries.

SCIENTIFIC AND TECHNICAL PERSONNEL

To carry out the purpose of the bill "to mobilize for the prosecution of the war all scientific and technical facilities and personnel" Section 5 amends the selective training and service act to transfer the control of occupational deferments of persons engaged in scientific and technical occupations or receiving scientific or technical training from the Manpower Commission to the Office of Scientific and Technical Mobilization. Its powers in this respect, however, are not final under the bill, but are "subject to direction by the Chairman of the War Manpower Commission." The bill adds no new functions for the wartime mobilization of scientific and technical personnel which are not already under other administrative agencies.

The effects of the features of the bill pertaining to personnel to which attention is particularly directed, however, are not confined to the period of the war emergency. Purpose (8) is "to promote interest in scientific and technical education and to provide for all qualified persons the means of scientific and technical training and employment." The Office is charged with the duty (Section 4b) "to formulate and promote projects and programs for the development and use of scientific and technical personnel and, when necessary, *to initiate and carry out such projects.*" This provision of the bill empowers any national administration which so chooses to place the government squarely in the business of scientific and technical education.

ADMINISTRATION

The Office of Scientific and Technical Mobilization (Sec. 3), is in charge of an Administrator who is appointed by the President, by and with the advice and consent of the Senate, and to serve at the pleasure of the President. His salary is fixed at $12,000. No qualifications for the Administrator are set forth in the bill. He is assisted by a National Science and Technical Board of six other members appointed by the President, of whom one each represents industry, agriculture, labor, and the consuming public, and two are scientists or technologists serving as members at large. These men are full-time employees at the rate of $10,000 a year. Their duties are such as the Administrator may assign to them. To establish the basic policies governing the administration of the act the bill proposes a National Scientific and Technical Committee. This consists (*a*) of the Board and (*b*) one representative each from such federal departments as the President may designate, four additional representatives of the consuming public, three additional scientists or technologists, six additional members representing labor, and six additional members representing management (who must include representation of small business). These additional committee members are appointed by the President and serve without compensation.

The number of government representatives on this policy committee depends upon the number of federal departments the President chooses to have represented. It would seem probable that at least five departments would be represented and possibly seven and the make-up of the committee would be:

Representatives of the government (probable)	6 to 8
Representatives of the consuming public	5
Scientists and technologists	5
Representing agriculture	1
From management (production and service)	7
Labor	7
Probable total	31 to 33

Thus would the determination of the future course of scientific and technical development in the United States be transferred to political control.

CONCLUSIONS

The Council of A.S.M.E. is opposed to the bill because

(1) The statement of "serious impediments" to the full development and application of the Nation's scientific and technical resources for the prosecution of war are misleading and not justified by the facts, a few of which are:

(*a*) The government has access to all scientific and technical data which it has authority to use in the interest of national defense or public welfare.

(*b*) Industrial and educational laboratories, guided by O.S.R.D., have been and are carrying on needed investigations for the Armed Forces and for war industry.

(*c*) This Society is directing and co-ordinating certain research activities for several government agencies.

(2) With respect to "peacetime progress and prosperity" the statement of impediments is without justification. It would be difficult to find another nation where scientific and technical progress has been greater or more widely distributed than in the United States since World War I.

(3) The transfer of existing functions pertaining to the mobilization of scientific and technical personnel from one government agency to another will cause confusion.

(4) The bill regiments invention and scientific and technical resources and education.

(5) The administrative board would consist of seven members only two of whom would necessarily be scientists or technologists; and the policies governing the administration of the act would be determined by a politically constituted committee of 30 or more persons of whom only five would necessarily be scientists or technologists.

For these reasons, and others, the Council of A.S.M.E. opposes the passage of the Kilgore Bill (S.702), or of any measure of similar intent.

1943 A.S.M.E. ANNUAL MEETING

Pennsylvania Hotel, New York, November 28–December 3, Scene of Largest Technical Meeting Ever Held by Society

MEMBERS and guests of The American Society of Mechanical Engineers virtually took over the entire convention facilities of the Hotel Pennsylvania, New York, N. Y., on the occasion of the Sixty Fourth Annual Meeting of the Society, November 29–December 3. In effect the 1943 Annual Meeting began on Sunday, November 28, because the Council and Group Delegates Conference, as well as a few committees, were in session most of that day. A series of joint sessions of the A.S.M.E. Applied Mechanics Division and the newly formed Society for Experimental Stress Analysis (S.E.S.A.) continued through Saturday of the busy week and wound up the largest program of Annual Meeting events ever scheduled.

REGISTRATION EXCEEDS 4000

In every particular, records were broken during the week-long meeting. Official registration figures ran beyond 3800, but inasmuch as there were no registration facilities available during the evenings when several largely attended technical sessions were scheduled, there is little doubt that more than 4000 persons were in attendance. Even the Annual Dinner topped all other such events in numbers attending.

Certainly there can be little doubt that never before has such an extensive program of technical sessions been offered nor so many sessions held simultaneously. Approximately 180 papers and addresses were delivered during the week. Attendance at sessions, even with the improved facilities available, crowded many of the meeting rooms to that packed capacity which, while creating some confusion and discomfort, nevertheless charged the atmosphere with intensity and a distinct feeling on the part of the participants that they must be making best use of their time because so many others had come along with them to listen to what was being offered. Chairmen grew worn and haggard conducting sessions that lasted long after reasonable hours of adjournment because there seemed to be so much to be discussed.

CONVENIENT ARRANGEMENTS

In most particulars it was agreed that the choice of the Hotel Pennsylvania was a fortunate one. Owing to its layout, the hotel's accommodations for conventions are separated from its other facilities and services. In the convention end of the Hotel ample facilities for registration and staff services were had in the very center of the group of principal meeting rooms, while additional rooms were readily accessible.

In only one particular did these services leave something to be desired and that was in the accommodations for the banquet. Fire ordinances prevented the seating of more than 1000 on the ballroom floor, although another 200 were accommodated in the balcony. So great was the demand for dinner tickets that it became necessary for the Dinner Committee to persuade the Hotel authorities to open the Keystone Room, adjacent to and on the same level with the ballroom balcony, and here another 350 persons were seated. Even with this added capacity several hundred persons were unable to attend the banquet.

VARIED AND EXTENSIVE PROGRAM

So extensive and varied have A.S.M.E. Annual Meetings grown that it becomes impracticable to report them fully. A majority of technical papers eventually find their way into Society publications with discussion and many are available in preprint form. Hence no attempt is made to cover them in such a report as this. Instead, attention is focused on the less technical and special features of these meetings and on matters that relate to Society business.

In this issue will be found, for example, brief reports of the sessions of the research, standardization, and code committees of the Society which seize upon the Annual Meeting as a place to present papers and reports and to conduct their business affairs. The report of the program enjoyed by the women, for which we are indebted to Mrs. E. B. Smith, chairman of publicity and printing for the Women's Events, is on page 80. Society business, conducted in meetings of the Council, in the Annual Business Meeting of the Society, and by the Group Delegates Conference, is variously reported. Brief notice is also given the plant visits, arranged by a committee headed by G. J. Nicastro; to the Annual Dinner and Honors Night, arranged by a committee with H. G. Ebdon as chairman, and to some of the other special dinners and luncheons; to the several "college reunions;" and to a few of the sessions, symposia, or "panels" of which little exists in the nature of prepared papers.

PROBLEM OF PUBLISHING PAPERS

What ultimately can be done in the way of publishing the vast amount of technical papers and addresses remains to be seen. The Society, in common with many other organizations, faces a paradox—a superfluity of papers and a shortage of paper. Were funds and editorial staff sufficient to handle the situation as completely as it deserves there would still remain the critical shortage of paper to put the brakes on a full report.

More than 50 papers were put into preprint form and will appear in the Society publications as soon as possible. The Committee on Publications still faces, however, the problem of making the best use of the remaining material. Several plans are under consideration and will be announced later.

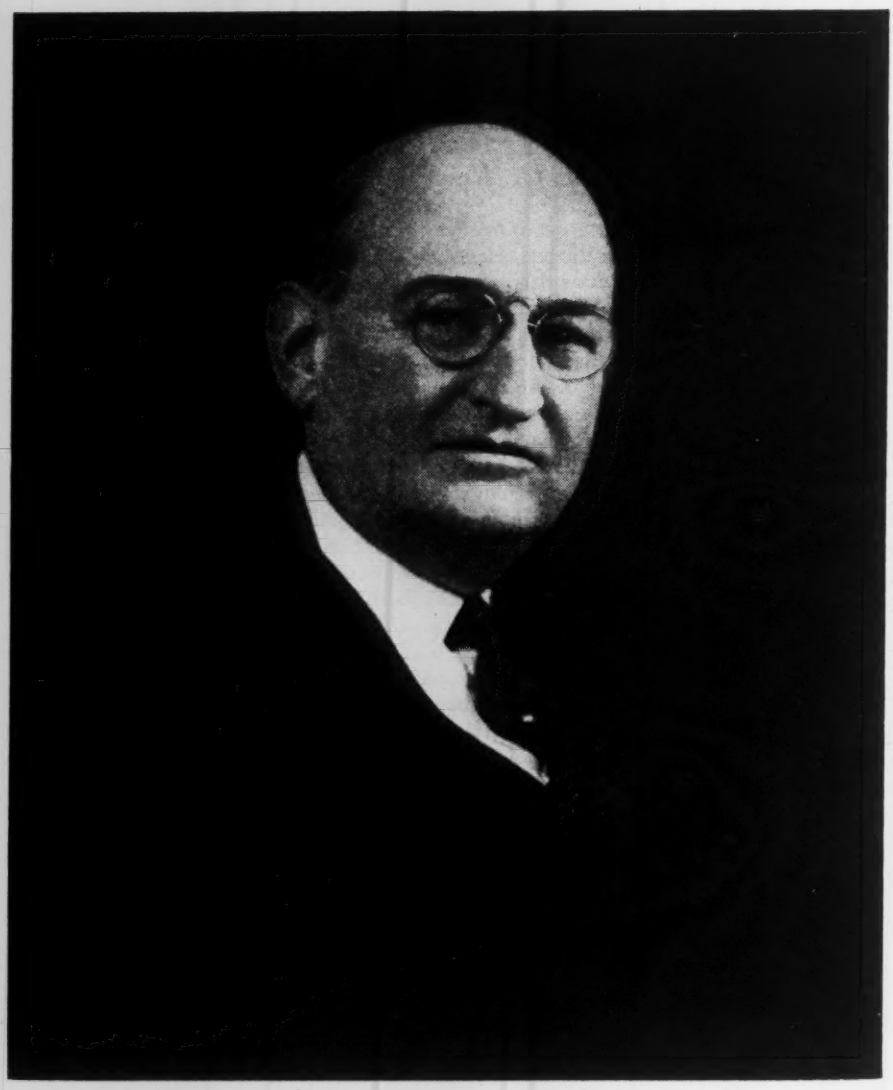
INFORMAL SUNDAY EVENING CONFERENCE

For several years the Society has utilized Sunday evening of its annual meeting as an opportunity for bringing together members of the Council, members of the Group Delegates Conference, and members of the Society's standing committees. At these informal "family gatherings" subjects of general interest and information are discussed and questions are asked and answered.

A unique feature of these Sunday evening gatherings has been the introduction and identification of all present by the secretary, C. E. Davies. This rapid-fire exhibition of an acute memory for names and faces has always astounded persons witnessing it for the first time and has always warranted a tremendous applause. Following these introductions this year the president introduced George T. Seabury, secretary, American Society of Civil Engineers, and his associate, Howard F. Peckworth, who had been invited to lay before members of A.S.M.E. the program of aid to A.S.C.E. members in collective-bargaining procedures which the times have made a serious problem for engineers.

COLLECTIVE BARGAINING FOR CIVIL ENGINEERS

Mr. Seabury reviewed the rather long and extensive activities of A.S.C.E. with the welfare of its members, particularly those involved in disputes over wage scales and working conditions.



Harold Vinton Coes

Retiring President of
The American Society
of
Mechanical Engineers
for 1943

Success in conspicuous measure attended these activities in several western states prior to the war, but since the intense unionization of industries has been sweeping the country the problem has been one of taking certain defensive actions whereby engineers will not be caught up in minority groups with large numbers of men in subprofessional and nonprofessional occupations.

It was announced that the A.S.C.E. had, at its recent meeting in Atlanta, Ga., authorized the employment of additional secretarial aides whose duties will be to assist engineers in local communities to set up bargaining agencies. An appropriation of $50,000 has been made to finance this work and a revision to the constitutions of the A.S.C.E. local sections has been suggested for adoption in those localities where the question is imminent or likely to become so.

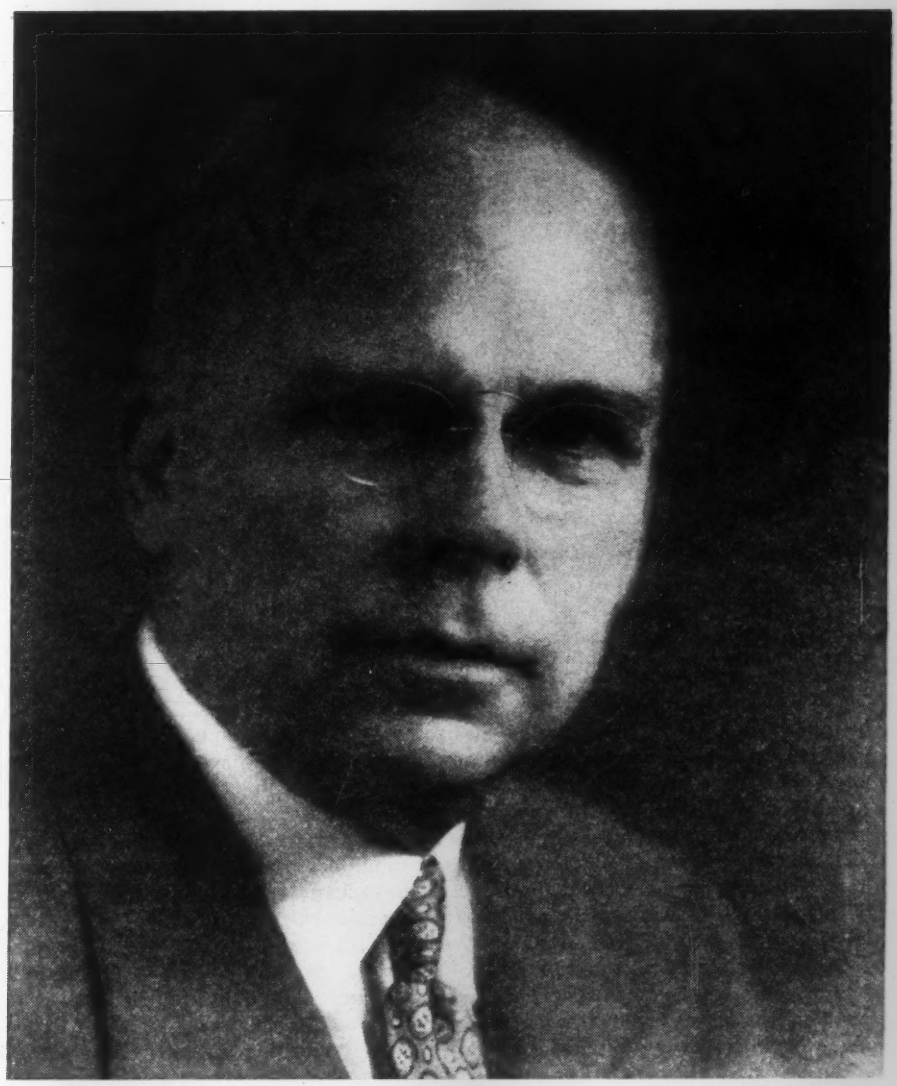
Great interest was provoked by Mr. Seabury's recital and many questions were raised, each of which either Mr. Seabury or Mr. Peckworth undertook to answer. To most A.S.M.E. members the subject was new; and it was evident that the opinion was prevalent that the membership of the two societies had aspects which might call for different methods of approach to the problem. It was generally agreed that the subject was one of the greatest importance, although there was no unanimity of opinion as to how the A.S.M.E. should approach it. It was announced that the Council had the subject under consideration. Without exhausting either questions or interest in the subject, discussion was finally terminated with a vote of sincere thanks to Mr. Seabury and Mr. Peckworth for their time and consideration.

CONGESTION OF ANNUAL MEETING PROGRAMS

The remainder of the evening was spent in a discussion, led by Nevin E. Funk, chairman of the Committee on Meetings and Program, on the vexing problem of the size of the Annual Meeting. Mr. Funk made a strong plea for the switching of many papers from the program of the Annual Meeting to the programs of the other Society meetings—Spring, Semi-Annual, and Fall—and to meetings of the local sections. It was brought out that some of the divisions—notably Applied Mechanics, Fuels, and Oil and Gas Power—held national meetings of their own, with the result that pressure on Society meetings for additional sessions was materially relieved. No conclusions were reached beyond general agreement that Annual Meetings were becoming too large and cumbersome with their numerous simultaneous sessions and that some solution should be sought as quickly as possible.

KETTERING ADDRESSES INGENUITY SESSION

Whether inventors are only born or can be developed, was the subject of a lively talk by Chas. F. Kettering, director of research, General Motors Corporation, at a meeting on "Education and Training," following a luncheon on Monday under the auspices of the Committee on Education and Training for the Industries.



Robert M. Gates

President of
The American Society
of
Mechanical Engineers
for 1944

Mr. Kettering said that too much information handicaps the inventor because he learns that his idea has been tried before with unsuccessful results. Don't go to the library and look up the history of the subject, he said. Don't get into the intellectual rut of thinking that previous experience necessarily gives an answer to your problem. The first thing to do is to decide whether or not the problem is really important enough to undertake to solve. If it is, try it over and over. The chances are always against success the first time. No disgrace is involved in preliminary failures There is no other way to get results than the tedious way of keeping on trying. Inventions, he said, are made in the head, not in the laboratory. College courses can stimulate creative thinking if they get away from too much reliance upon past history.

INGENUITY DISCUSSION CONTINUED AT EVENING SESSION

Discussion of ingenuity was continued at a well-attended session Monday evening. W. L. Merrill, engineer of works laboratory, General Electric Company, pointed out that Yankee ingenuity plus engineering training is an unbeatable combination. Yankee ingenuity will soon be recognized throughout the world, he believes. Research affords an opportunity for the application of ingenuity, but too much plain engineering is called "research." He pointed out also that there is a great difference between ingenuity and executive ability.

Henry T. Heald, president, Illinois Institute of Technology, expressed the view that the college population is not necessarily the top intellectual group. Industry can assist in the development of men with ingenuity by subsidizing postgraduate work.

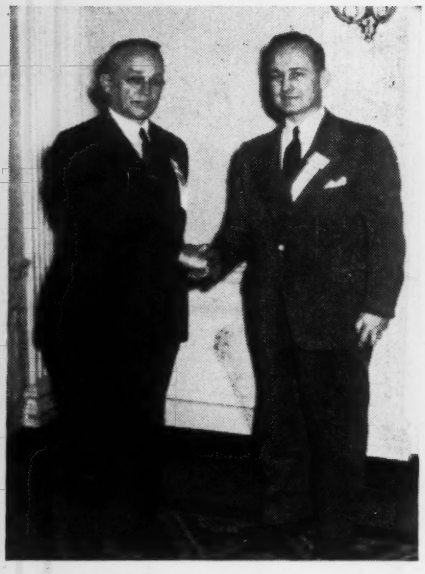
Insight is better than logic, according to Elliott D. Smith, member A.S.M.E., professor of economics, Yale University. He raised the questions, why didn't the telegraph companies develop the telephone—why didn't the gas companies develop the electric light? Industrial concerns today, he said, are more keenly interested in scientific research than they were in the past. In the discussion which followed the scheduled talks, a speaker from the floor stressed the point that a serious defect in our present educational system is that more credit is given to those who conform to the accepted pattern than to those who display real ingenuity.

PRODUCTION RESEARCH PANEL

Manpower problems were the chief topic of discussion at a panel meeting on Tuesday evening under the auspices of the Research Committee and the Manufacturing Engineering Committee. Harvey N. Davis, past-president A.S.M.E., director OPRD, and president, Stevens Institute of Technology, acted as chairman with Erik Oberg, editor, *Machinery*, as co-chairman. The present need for more output in proportion to input was stressed by L. C. Morrow, editor, *Factory Management and Maintenance*. He told how electronic devices are helping to accomplish this purpose. He maintained, however, that the study of people is the most important need in the field of production research.

FIRST IN LINE

(Dean R. L. Sackett, the first to register, having his badge pinned on by Miss Mae Lenen of the A.S.M.E. Staff.)



CONGRATULATIONS

(C. C. Austin, Chairman 1943 Local Sections Delegates Conference, congratulates H. C. Carlson, chairman for 1944.)

ALL PRESIDENTS

(President-Elect R. M. Gates, K. M. Cameron, President, The Engineering Institute of Canada, and President H. V. Coes.)

The importance of manpower was emphasized also by Philip S. Criblet, personnel manager, Worthington Pump and Machinery Corp. We should have personnel engineers, he said, of the five M's in industry—machines, money, materials, minutes, and men—the men are the most essential.

C. D. Mercer, president, Wilcox & Gibbs Sewing Machine Co., suggested that much benefit might result from a careful study of the relationship between management and men. Sometimes it is necessary to use manpower extravagantly, according to Arthur A. Schwartz, chief tool research engineer, Bell Aircraft Corp. As an instance he cited a washout on the Burma Road, when the damage was repaired by thousands of Chinese carrying earth in baskets. The same job could have been done with a small fraction of the number of men if they had had steam shovels and bulldozers, but the machinery was not there. He suggested that the best way to increase the effectiveness of manpower was through improvement in tools and the use of tools.

Progress made in wood development was brought out by Thomas D. Perry, member A.S.M.E., development engineer, The Resinous Products and Chemical Co. He maintained that further research with respect to wood was an important need in the production field. Following the talks by the members of the panel there was lively discussion from the floor, ended by an excellent summation by Chairman Davis.

MANAGEMENT DIVISION DISCUSSES INCENTIVES

The only change war has brought about in connection with wage incentives is that more people are aware of the need for increased production per worker, according to John F. Campbell, plant manager, International Projector Corporation, speaking at a session on "Incentives" on Wednesday morning. It is highly important, he emphasized, that any wage-incentive plan be carried out in good faith.

In plants where labor and management have arrived at an arrangement of complete co-operation, according to James F. Lincoln, president, the Lincoln Electric Company, production rates more than four times those in other plants have been attained. The foundation of any incentive plan, he said, is to make the worker feel that he is part of a team and profits proportionately from the success of the organization.

John W. Nickerson, director, Management Consultant Division, W.P.B., pointed out that often the margin between success and failure is a small one. Anything that encourages the worker to greater production is helpful. Most workers respond when a reward is offered for better performance. There are all too few plants, however, where wage-incentive systems have been installed on a thoroughly engineered basis. By doing this throughout industry he estimated that a national increase in production might be obtained as great as 35 per cent.

POSTWAR PLANNING

Postwar planning was discussed at an extremely interesting session on Tuesday afternoon under the auspices of the Management Division. William R. Mullee, American Hard Rubber Company, acted as chairman. This war is unlikely to end all at once, as did World War I, in the opinion of John F. Fennelly, Executive Director, Committee for Economic Development. All indications are, he said, that the war in the Pacific will continue for a considerable period after the end of the war in Europe. Army experts now estimate that we may be able to cut our munitions production materially and still have enough to fight a full-scale war against Japan.

The first problem we shall face after the defeat of Hitler will be a wholesale termination of outstanding war contracts. The scope of this problem is enormous as there are more than 100,000 prime contracts and more than 1,000,000 subcontracts. "We believe," Mr. Fennelly said, "that any policy of continuing to produce unneeded war goods merely for the sake of maintaining employment will slow down the reconversion of industry. Instead, we are convinced it will be far less costly from the standpoint of the national economy to cancel these contracts promptly and to provide adequate compensation for the workers thrown out of employment." Our objective must be the attainment of higher levels of peacetime production than we have ever known before. If that can be done, the employment problem will largely take care of itself.

Mr. Fennelly also expressed the opinion that there was little reason for private industry to fear that the government would continue the operation of government-owned plants after the end of the war.

Col. Willard T. Chevalier, McGraw-Hill Publishing Co., speaking in place of Paul G. Hoffman, chairman, Committee for Economic Development, who was unable to be present, discussed possible postwar trends. Later, Dr. Walter Rautenstrauch, Columbia University, commented at some length on

W. R. WOOLRICH AND O. W. BOSTON

A. L. NICOLI AND E. H. NEFF

G. A. STETSON AND LIONEL S. MARKS

what the two speakers had said and expressed his own personal views on the situation.

RAILROAD TOPICS

Brigadier General Charles D. Young, Deputy Director of the Office of Defense Transportation, Washington, D. C., led a discussion on "Factors Involved in the Selection of Railroad Motive Power," at a session on Wednesday afternoon. Roy V. Wright, vice-president Simmons-Boardman Publishing Corporation, acted as chairman. "Men and women of the railroad industry have demonstrated during the war years their ability, resourcefulness, and industry in doing more with less, than anyone, including themselves, thought was possible," C. B. Bryant, engineer of tests, Southern Railway System, Washington, D. C., told a session of the Railroad Division on Thursday morning. He predicted unprecedented postwar competition from other forms of transport, but said this would spur modernization of rail equipment and efficiency of operation. An almost limitless increase of postwar travel was predicted by Edward G. Budd, president of the Edward G. Budd Manufacturing Co., if the railroads have the foresight to provide cheaper, faster, and more comfortable coach trains and generally modernize their facilities. Speaking on "Passenger Cars After the War," he said that wartime travel by young men and women in the armed services would make them and their families travel-minded and that the public generally would want to travel more when peace comes.

Following a largely attended luncheon on the same day, William I. Cantley, mechanical engineer, American Association of Railroads, spoke on postwar research possibilities in railway equipment.

"Progress has been somewhat retarded during the war period because of the inability to secure certain materials and, as a result, some phases of locomotive and car construction have remained static, but this is a temporary condition which we hope will soon be alleviated. In the meantime, planning and development are being carried forward and as soon as it becomes possible to do so, the use of higher grades of steel and various alloys will be greatly extended and entirely new applications of lighter weight and stronger materials will enter all fields of railroad construction.

MANAGEMENT LUNCHEON

The job ahead for management was discussed from various angles at a luncheon under the auspices of the Management Division on Tuesday. James M. Talbot, vice-president, S. S. White Dental Manufacturing Co., acted as chairman. The greatest factor that determines the success or failure of management is the way it deals with the human element, according to Lawrence A. Appley, deputy chairman, W.M.C. Mr. Appley's paper was read by Mr. Talbot as Mr. Appley was unable to be present. Managements may come and managements may go, but the job goes on forever. In peace or in war, it is management's job to meet the challenge of the times, plot the course, and see that results are accomplished .

John R. Bangs, general manager, personnel and industrial relations, Edward G. Budd Manufacturing Co., pointed out that postwar employment was a major job ahead of management.

A significant point was made by Prof. Ralph M. Barnes, University of Iowa, when he said that one of management's chief responsibilities was to determine how much should be paid to a worker for doing a particular job. General wage levels may be determined by agencies of the government, or collective bargaining, but individual job evaluation and work measurement are the functions of management. Mr. Barnes' paper was read by Mr. Talbot.

Wallace Clark suggested that management's job was to provide the "know how." Dr. Lillian M. Gilbreth pointed out that it was important to train workers to do their jobs with a minimum of fatigue. Not the least important future job of management is the establishment of adequate "quality control" according to Charles S. Gotwals, quality manager, SKF Industries.

While the conversion of industry to war production tested the resourcefulness of management to an unprecedented degree, the reconversion to peacetime operation will present an even greater challenge. This view was presented in a paper by Prof. Paul E. Holden, Stanford University, read by Mr. Talbot.

Management should study and make greater use of improved methods, according to H. B. Maynard, president, Methods Engineering Council. He said that the technique of improving methods had proceeded much faster than its adoption by management. Dexter S. Kimball, dean emeritus, Cornell College of Engineering, emphasized the importance of restoring the freedom of enterprise as soon as the war is over. Dean Kimball's comments were read by Mr. Talbot.

At the close of the panel, H. V. Coes, president of the Society, presented a brief summary of all the contributors to the discussion.

SESSION ON MANAGEMENT IN THE FEDERAL GOVERNMENT
(E. B. Young, A. S. Flemming, Brig. Gen. C. F. Robinson, President Coes, and J. M. Juran.)

AFTER A RAILROAD SESSION
(O. J. Horger, Rupen Eksergian, A. I. Lipetz, R. V. Wright, and O. W. Hovey.)

TALKING OVER ARRANGEMENTS
(R. F. Gagg, Ernest Hartford, J. M. Clark, C. L. Tutt, Jr., and John E. Younger.)

TRAINING OF WOMEN

Women ask more questions than men and insist on an answer which completely satisfies them, according to B. H. Saltzer, in charge of engineering training at the Wright Aeronautical Corporation's plant in Paterson, N. J., in an address on "Aircraft Engine Test Engineering Training for Women," at the Education and Training session on Tuesday morning. He said that instructors who previously taught men agree that other differences between teaching men and women are that women accept direction with fewer reservations and complete assignments more conscientiously; women resent more than men any requirement or assignment which affects their home life or activities not connected with their work; and they are more articulate than men when given reason for dissatisfaction. Miss Frances M. Tallmadge, personnel planning and research department, RCA, expressed the opinion that too many people give lip service to the possibilities of training and using women in technical work. They see it as an expedient of the moment; the only white hope on a dark horizon of technical personnel. They try it because it seems the only way out, but they do so with a tongue-in-cheek attitude. That attitude is quickly and subtly transmitted to the cadettes and gives them an extra hurdle to jump. Most women in industry have progressed because someone had faith that they could do a job and do it well. They lived up to that expectation. Wholehearted support and conviction that the girls can do the job is the largest factor in their success."

MANAGEMENT IN THE FEDERAL GOVERNMENT

On Tuesday evening, under the chairmanship of Harold V. Coes, president A.S.M.E., the Management Division conducted a panel discussion on accelerating scientific management in the Federal Government. Members of the panel were: Arthur S. Flemming, commissioner, U. S. Civil Service Commission, Brigadier General C. F. Robinson, director, Control Division, Army Service Forces; Commander R. M. Paget, Management Engineers' Office, Navy Department; Edgar B. Young, of the Bureau of the Budget; and J. M. Juran, member A.S.M.E., assistant administrator, Office of Lend Lease Administration.

The panel addressed itself to the discussion of such subjects as the way in which the problem of management in the Federal Government differed from that in private business; the possibility of applying the principles of management as developed in private business to Federal Government operation; and what the Federal Government had already done along these lines. Questions and comments from the floor supplemented the illuminating and frank discussion of members of the panel.

It was evident that in many instances forward-looking administrators had made earnest attempts to conduct the affairs of Government agencies along lines that would be considered good practice in private business and that attempts were made to utilize the tools of management. In certain areas considerable achievements had been made. Many specific instances were cited of simplification of procedures and forms and of the elimination of waste and unnecessary personnel and equipment. It was pointed out that governmental agencies were forced to operate within a framework of democratic ideals and Federal laws which were not factors which private business was forced to consider. Many attempts to introduce modern management methods had presumably failed because administrators had not given sufficient attention to the task of making clear to the Congress the reasons and advantages of their proposals.

At the close of the session some consideration was given to the question of the value of an interchange of ideas and a frank discussion of problems and techniques between public administrators on the one hand and representatives of private business on the other. It was generally agreed that the discussion stimulated by the panel had been worth while and that further attempts to bring together administrators in private and public

enterprises should be made. Much could be learned on both sides, and The American Society of Mechanical Engineers afforded an excellent forum for such discussions.

1943 BUSINESS MEETING WELL ATTENDED

Attendance at the 1943 Annual Business Meeting of the Society was larger than normal this year although no actions profoundly influencing the life of the Society were taken.

President Coes called the meeting to order in the Georgian Room on Tuesday afternoon at 4 o'clock. Secretary Davies called attention to the Annual Report of the Council for 1943 (see pages 32–38 of this issue) and presented a brief summary of it. He also announced the publication of an edition of a translation of Carnot's "Reflections on the Motive Power of Heat," translated by Robert H. Thurston, first president of the A.S.M.E. This edition, said Mr. Davies, had been set by hand by Robert H. Roy, of Baltimore, Md., a member of the Society, and afforded not only an excellent and beautiful example of typography but also an opportunity for engineers to add to their libraries a copy of this great classic of mechanical-engineering literature.

Secretary Davies also noted the work of the A.S.M.E. Manufacturing Engineering Committee, organized since the 1942 Annual Meeting, at the suggestion of the Office of Production Research and Development, War Production Board, whose executive secretary, H. B. Lewis, was giving full time as a member of the headquarters staff. The interesting possibilities of increased production by milling with cutters having negative rake were being studied by the committee and some reports on this technique were being discussed at the meeting. Members of the committee are H. V. Coes, Col. James L. Walsh, L. C. Morrow, Fred Colvin, and Eric Oberg.

On behalf of the Finance Committee, George L. Knight, chairman, presented the annual finance report which will be found on pages 39–44 of this issue.

On motion, the report of the Council and the finance report, as well as the acts and transactions of the Council and the Society for the year, were approved.

Following a report of the tellers of elections, the officers to serve with the beginning of the administrative year on December 2 were declared elected.

NEWLY ELECTED OFFICERS

The newly elected officers and members of the Council are as follows:

President, ROBERT M. GATES, fellow A.S.M.E., president and director, Air Preheater Corporation, New York, N. Y.

Vice-president, DAVID W. R. MORGAN, manager, steam division, Westinghouse Electric and Manufacturing Company, Philadelphia, Pa.

Vice-president, JONATHAN A. NOYES, district manager, Sullivan Machinery Company, Dallas, Texas.

Vice-president, FORD L. WILKINSON, JR., dean of engineering, Speed Scientific School, University of Louisville, Louisville, Ky.

Vice-president, RUDOLPH F. GAGG, assistant to the general manager, Wright Aeronautical Corporation, Paterson, N. J.

Manager, JAMES M. ROBERT, dean of the College of Engineering, Tulane University of Louisiana, New Orleans, La.

Manager, SAMUEL H. GRAF, professor and head of department of mechanical engineering and director of research, Oregon State College, Corvallis, Ore.

Manager, ALTON B. CHICK, assistant vice-president and engineer, Manufacturers Mutual Fire Insurance Company, Providence, R. I.

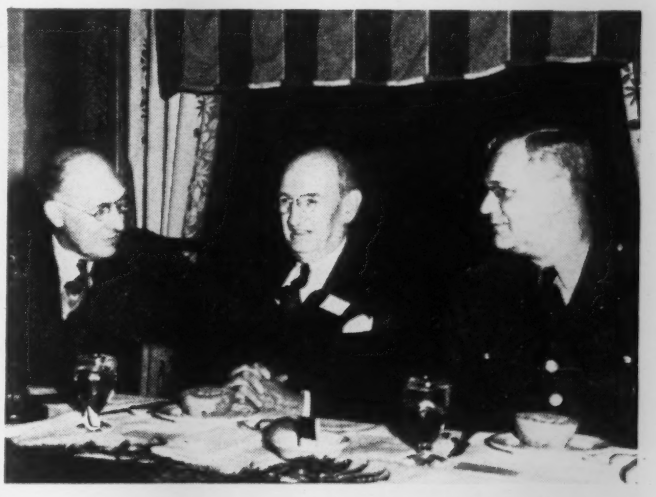
Manager, J. CALVIN BROWN, head of firm of J. Calvin Brown, Los Angeles, Calif.

NOMINATING COMMITTEE PERSONNEL

Ford L. Wilkinson, Jr., chairman of the Committee on Local

AT ONE OF THE SESSIONS

(*Left to right:* Dean R. L. Sackett applauding, Past-President A. A. Potter, Dean C. P. Bliss, Willis H. Carrier.)

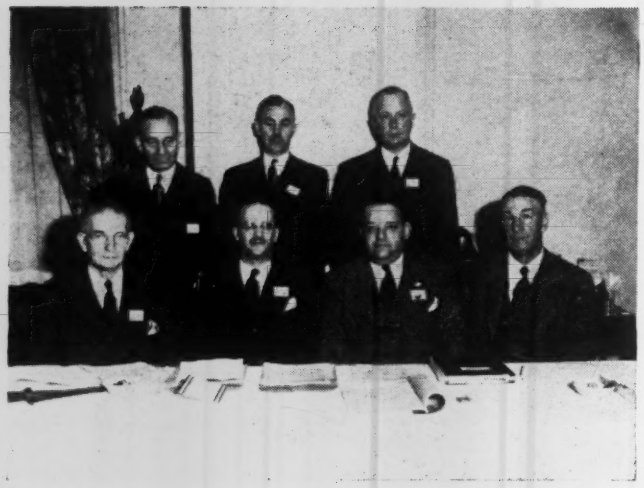


AT THE LUNCHEON ON INGENUITY

(C. F. Kettering, President Coes, Col. C. E. Davies, Secretary A.S.M.E.)

ENJOYING A CHAT

(Geo. J. Nicastro, S. H. Graf, and V. M. Palmer.)



SOME MEMBERS OF NOMINATING COMMITTEE FOR 1944
(*Seated, left to right:* F. O. Hoagland, Geo. J. Nicastro, chairman, J. P. Magos, secretary, and A. M. Ormond. *Standing, left to right:* H. R. Westcott, J. Stanley Morehouse, and E. V. David.)

AT THE AVIATION, RUBBER, AND PLASTICS SESSION
(G. M. Kline, G. H. Dietz, and W. M. White.)

LIEUT. A. MARUM OF THE ORDANCE DEPARTMENT DEMONSTRATES THE ACTION OF THE ARMY'S NEW CARBINE TO AN INTERESTED GROUP
(*Left to right:* Kilshaw McH. Irwin, I. M. Stein, W. A. Carter, A. G. Christie, George A. Stetson, R. L. Sackett, and Lieutenant Marum.)

Sections, announced the personnel of the Nominating Committee for 1944, as follows:

Group I

FRANK O. HOAGLAND, Pratt and Whitney Company, Charter Oak Boulevard, West Hartford, Conn.

H. R. WESTCOTT (first alternate) Westcott and Mapes, Inc., 139 Orange St., New Haven, Conn.

JOSEPH W. ZELLER (second alternate), department of mechanical engineering, Northeastern University, Boston, Mass.

Group II

GEORGE J. NICASTRO, Combustion Engineering Company, 200 Madison Ave., New York, N. Y.

E. V. DAVID (first alternate) Air Reduction Sales Company, 60 East 42d St., New York, N. Y.

A. EHBRECHT (second alternate), Gries Reproducer Corporation, 780 East 133d St., New York, N. Y.

Group III

J. STANLEY MOREHOUSE, dean, School of Engineering, Villanova College, Villanova, Pa.

VIRGIL M. PALMER (first alternate), Eastman Kodak Company, 1669 Lake Ave., Rochester, N. Y.

C. H. HARRINGTON (second alternate), University of Buffalo, Buffalo, N. Y.

Group IV

A. M. ORMOND, Savannah Sugar Refining Company, Savannah, Ga.

E. E. WILLIAMS (first alternate), Duke Power Company, Charlotte, N. C.

J. MACK TUCKER (second alternate), Estabrook Hall, University of Tennessee, Knoxville, Tenn.

Group V

DARWIN S. BROWN, Cincinnati Gas and Electric Company, 4th and Main Streets, Cincinnati, Ohio

S. M. WECKSTEIN (first alternate), Timken Roller Bearing Company, Canton, Ohio.

E. M. SAMPSON (second alternate), Felber Biscuit Company, Grant Ave. and McCoy St., Columbus, Ohio

Group VI

J. P. MAGOS, Crane Company, 836 S. Michigan Ave., Chicago, Ill.

C. F. MOULTON (first alternate), Nebraska Power Company, 4th and Jones Sts., Omaha, Neb.

D. P. MORSE (second alternate), General Motors Corporation Speedway City, Indianapolis, Ind.

Group VII

W. H. KASSEBOHM, Production Engineering Company, 940 Dwight Way, Berkeley 2, Calif.

ALF HANSON (alternate), General Electric Company, 235 Montgomery St., San Francisco, Calif.

Group VIII

H. L. CRAIN, Kansas City Power and Light Company, 115 Grand Ave., Kansas City, Mo.

WM. T. ALLIGER (first alternate), P. O. Box 2217, Houston, Texas

HENRY M. ROBINSON (second alternate), Dallas City Water Works, 112 City Hall, Dallas, Texas

At an organization meeting of the 1944 Nominating Committee, George J. Nicastro was made chairman of the committee and J. P. Magos, secretary

SPEAK AT BUSINESS MEETING

Commander J. C. Stone, of the United States Navy, spoke with appreciation of the assistance given him by the Society in his duties of recruiting officers and men and said that there was still need for the commissioning of more engineers.

On the subject of patents and patent reform, John W. Kittredge, member A.S.M.E., and H. H. Snelling, member A.S.M.E. spoke. A. A. Bato, member A.S.M.E., called attention to the plans of the American Society of Civil Engineers in the field of collective bargaining and expressed the hope that the A.S.M.E. would consider the question also.

ELLIOTT TOASTMASTER AT DINNER

Taxing the facilities of the Hotel Pennsylvania to the utmost, nearly 1600 members and guests of The American Society of Mechanical Engineers assembled on Wednesday evening, December 1, for the 1943 Annual Dinner and Honors Night program. In spite of the fact that tables had been set in the balcony of the ballroom and in the Keystone Room which adjoins the balcony, it was necessary, as H. B. Ebdon, chairman of the Dinner Committee announced, to disappoint about 300 persons who had applied for tickets too late to be accommodated.

Acting as toastmaster was Edward C. Elliott, president, Purdue University, whose wit and repartee constituted the bright spots between the more serious portions of the program. When the diners, including many who came into the balconies from the Keystone Room, had been brought to a reasonable semblance of order, President Elliott introduced Thomas B. Allardice, member A.S.M.E., who led in the singing of the national anthem. Leslie N. Leet, member A.S.M.E., played the organ.

HONORING THE "OLD GUARD"

One of the features of A.S.M.E. Annual Dinners is the presentation of special badges to "fifty-year members" of the Society. At this year's dinner, three of the seven so honored were present, R. W. Boenig, Edwin C. Knapp, and Clement F. Street. Other fifty-year members were: A. J. Purinton, Carleton A. Read, A. W. Stanley, and William R. Webster. Mr. Coes presented the badges to the three members who were at the dinner.

At the call for members of more than 60 years' standing, Edward Needles Trump, who joined the Society during the first year of its history, was found to be present. Calls for "fifty-five," "forty-five," "forty," and "thirty-five" brought larger groups to their feet to acknowledge the applause.

Seated at the speaker's table were many past-presidents of the Society; officers and representatives of other Societies, including K. M. Cameron, president, The Engineering Institute of Canada; and the medalists and persons who introduced them. These President Elliott presented to the audience in groups from time to time during the program.

CONFERRING OF HONORS

For several years A.S.M E. Honors Night has been combined with the Annual Dinner. Recipients of honorary memberships and awards seated at the speakers' table, are escorted singly by marshals to the president, introduced to him by the chairman of the Board of Honors and Awards, with the reading of the citation, and are then greeted by the president, who bestows the medals and certificates. Acting in the capacity of marshals this year were Carl L. Bausch, member of the Board of Honors and Awards, and Eugene W. O'Brien, member of the Committee on Medals. D. C. Jackson, chairman of the Board of Honors and Awards, read the citations.

The following awards were conferred:

The Junior Award, to TROELS WARMING, junior A.S.M.E., for his paper "Power Pulsation Between Synchronous Generators."

The Worcester Reed Warner Medal, to IGOR I. SIKORSKY, fellow A.S.M.E., "for contributions inspiring creative engineering, especially in aeronautics." (Mr. Sikorsky was not present to receive the award.)

The Holley Medal, to VANNEVAR BUSH, "for machines used in easing applied mathematics from computational barriers."

The A.S.M.E. Medal, 1943, to LEWIS K. SILLCOX, fellow

RECEIVES ANOTHER HONOR

(*Left to right:* President Coes, Past-President Kimball receiving Gantt Medal from Wallace Clark, and Past-President Davis.)

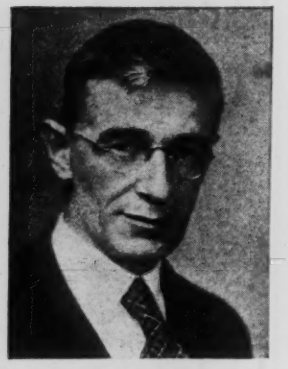
IN ATTENDANCE AT CHIP-CONTROL SYMPOSIUM

(M. F. Judkins, V. H. Ericson, and T. L. Langdon.)

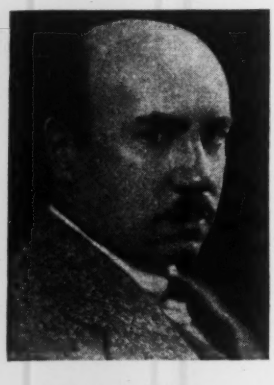
AT THE MANAGEMENT LUNCHEON

(*Left to right:* Wallace Clark, John R. Bangs, H. B. Maynard, Lillian M. Gilbreth, James L. Talbot, Chairman, and H. V. Coes, President.)

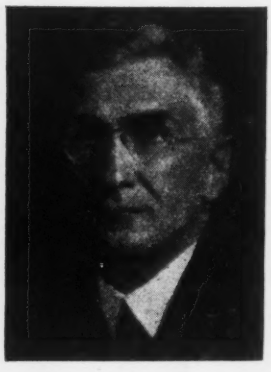
Recipients of Medals and Awards



VANNEVAR BUSH
(Holley Medal.)

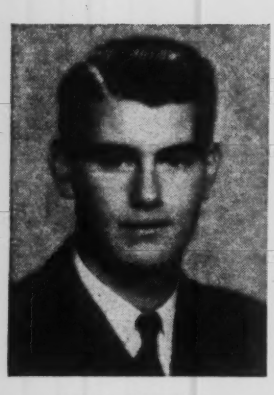


IGOR I. SIKORSKY
(Warner Medal.)



L. K. SILLCOX
(A.S.M.E. Medal.)

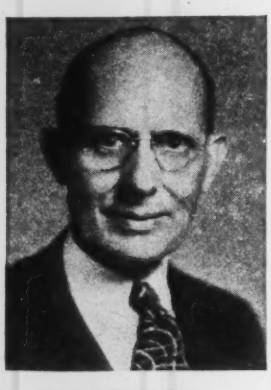
TROELS WARMING
(Junior Award.)



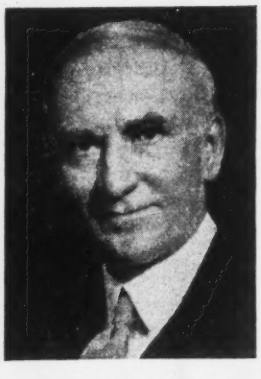
W. L. HUTTON
(Undergraduate Student Award.)

M. C. KAZEN
(Charles T. Main Award.)

B. J. LAZAN
(Alfred Noble Prize.)



C. F. KETTERING
(A.S.M.E. Medal, 1940; The John Fritz Medal.)



DEXTER S. KIMBALL
(Gantt Medal.)

A.S.M.E., "pre-eminent learned technologist—lover of widsom—inspirer of men."

The A.S.M.E. Medal, 1940, to CHARLES F. KETTERING, member A.S.M.E., "for outstanding inventions and research."

Two other awards were announced as having been conferred at the luncheon of the Council with Student Members, The Student Award, to ENSIGN W. L. HUTTON, U.S.N.R., and the Charles T. Main Award, to M. C. KAZEN, Junior A.S.M.E. An account of the luncheon at which these awards were presented forms a part of this report.

Certificates of honorary membership were conferred on the following:

FRANCIS BLOSSOM, fellow A.S.M.E., partner, Sanderson and Porter, New York, N. Y.

RALPH BUDD, president, Burlington Lines, Chicago, Ill. (Mr. Budd was unable to be present at the dinner to receive the certificate.)

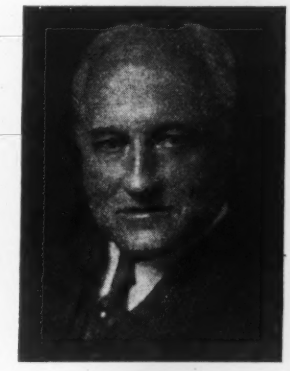
EDWARD N. TRUMP, fellow and past vice-president, A.S.M.E., senior member, E. N. and C. C. Trump, Syracuse, N. Y.

ROY V. WRIGHT, fellow and past-president, A.S.M.E., vice-president and secretary, Simmons-Boardman Publishing Company, New York, N. Y.

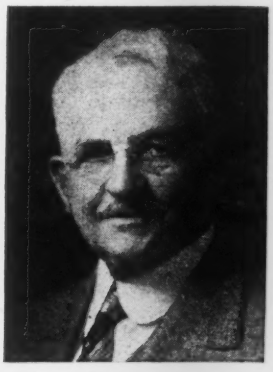
It was announced that a fifth honorary membership had been conferred on LIEUTENANT GENERAL ANDREW G. L. MCNAUGHTON, general officer commanding, Canadian Army Overseas, and president, National Research Council, Ottawa, Canada, at the joint meeting, Toronto, Canada, Sept. 30–Oct. 2, 1943, of The Engineering Institute of Canada and The American

Made Honorary Members of the A.S.M.E.

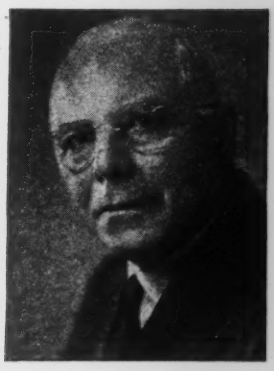
RALPH BUDD



FRANCIS BLOSSOM



EDWARD N. TRUMP



ROY V. WRIGHT

New Members of the 1944 A.S.M.E. Council

Vice-Presidents

DAVID W. R. MORGAN

JONATHAN A. NOYES

RUDOLPH F. GAGG

FORD L. WILKINSON, JR.

Managers

JAMES M. ROBERT

SAMUEL H. GRAF

ALTON C. CHICK

J. CALVIN BROWN

AFTER THE DINNER
(K. M. Cameron, President, E.I.C., and L. K. Sillcox, A.S.M.E. Medalist.)

ALL WELL KNOWN
(Past-Presidents W. L. Batt and A. G. Christie, Dr. C. F. Kettering, and Dr. D. C. Jackson.)

L. K. SILLCOX RECEIVES A.S.M.E. MEDAL
(Dr. D. C. Jackson presents Mr. Sillcox to President Coes.)

Society of Mechanical Engineers. (See MECHANICAL ENGINEERING, November, 1943, pages 830–831.)

CONFERRING OF JOINT AWARDS

Three awards given jointly by A.S.M.E. and other bodies were this year conferred at the A.S.M.E. Annual Dinner—the Gantt Medal, the Alfred Noble prize, and the John Fritz Medal. The ceremonies were more involved than in the case of A.S.M.E. awards as the recipients were presented to the representatives of the medal and prize boards concerned.

The Gantt Medal was conferred on DEXTER S. KIMBALL, honorary member and past-president, A.S.M.E., dean emeritus, College of Engineering, Cornell University, Ithaca, N. Y., "for outstanding attainment in the teaching and practice of industrial management and for distinguished contributions to its literature." Dean Kimball was presented by Harvey N. Davis, past-president A.S.M.E. and president, Stevens Institute of Technology, and the medal was conferred by Wallace Clark, member A.S.M.E., chairman of the Gantt Medal Board of Award.

In presenting the Alfred Noble Prize to BENJAMIN J. LAZAN, junior A.S.M.E., vice-president, Sonntag Scientific Equipment Corporation, Greenwich, Conn., for his paper, "Some Mechanical Properties of Plastics and Metals Under Sustained Vibrations," James K. Finch, professor of civil engineering, Columbia University, speaking on behalf of the committee, gave a brief survey of the life of Alfred Noble and explained the character and purpose of the prize.

The third presentation was that of the John Fritz Medal for 1944, highest honor within the power of engineers of the United States to confer, was to CHARLES F. KETTERING, member A.S.M.E., vice-president and director of research, General Motors Corporation, Detroit, Mich. This medal is given every year by one of the four Founder Societies The 1944 medal being given to a mechanical engineer, presentation ceremonies were made a part of the 1943 A.S.M.E. Honors Night. F. Malcolm Farmer, member A.S.M.E., presented Mr. Kettering for the award, which was conferred by James L. Parker, past-president A.S.M.E. and chairman of the John Fritz Medal Board of Award.

PRESIDENT COE'S ADDRESS

According to custom, the Presidential address was one of the principal features of the 1943 A.S.M.E. Annual Meeting. Mr. Coes' address bore the title, "Wartime Research and Development—a Molder of Engineering." It consisted of a recital of a host of developments now under way, many of them stimulated by the war, which, under favorable conditions, should make possible a high level of employment under the American system of free enterprise and provide a rich field of work and service for mechanical engineers. Mr. Coes' address appears in this issue, pages 29–31.

PRESIDENT-ELECT GATES SPEAKS

With amusing references to Purdue University, Mr. Gates' alma mater, the president-elect was introduced by President Elliott of Purdue. Mr. Gates' response drew from President Elliott a brilliant rejoinder when he had finished speaking.

On behalf of the new members of the A.S.M.E. Council, the President-Elect expressed appreciation of the opportunity afforded them to render greater service to the Society. The Council would, he assured his listeners, do its best to carry on earnestly the war activities of the Society and to develop the postwar plans already started. He bespoke the counsel and co-operation of all divisions, all local sections, and all members, and pledged his best efforts in behalf of the objectives he had mentioned.

RALPH S. DAMON DELIVERS ADDRESS

The 1943 Annual Dinner address was delivered by Ralph S. Damon, member A.S.M.E., vice-president and general manager, American Airlines, Inc., New York, N. Y. The title of Mr. Damon's address, which appears on pages 13 and 14 of this issue, was "The Philosophy of Aviation."

In introducing Mr. Damon, President Elliott expressed bewilderment at the title of the address and challenged the speaker to defend his thesis. Mr. Damon caused considerable amusement in his introductory remarks by including "members of the Purdue Alumni Association" in his salutation. When he had completed his address, President Elliott admitted that he had defended his thesis convincingly.

The Presidents' Reception followed the dinner, and dancing in the Georgian Room engaged a considerable number of members and guests until a late hour. J. H. Sengstaken was in charge of music and dancing, and Mrs. F. M. Gibson, Jr., of the "asKme" girls.

COUNCIL MEETS SUNDAY AND FRIDAY

The Council of the Society met at the Hotel Pennsylvania on Sunday, November 28, and on Monday, November 29, and then

PRESIDENT COES PRESENTS THE JOHN FRITZ MEDAL TO C. F. KETTERING

COL. WILLARD CHEVALIER WHO SPOKE ON POSTWAR PLANNING

PRESIDENT COES PRESENTS THE HOLLEY MEDAL TO VANNEVAR BUSH

adjourned until Friday, December 3. President Coes presided at all sessions. Actions of general interest are summarized in what follows.

COES THANKS THE COUNCIL

After calling the Council to order President Coes expressed his appreciation of the support to his administration which members of the Council had given.

ACTIONS OF EXECUTIVE COMMITTEE

Certain actions taken by the Executive Committee of the Council at its meeting on the morning of November 28 were reported by the Secretary.

A formal procedure had been worked out for the recognition of employees of the Society who had given 25 years or more of service.

The agreement between the A.S.M.E. and The Engineering Institute of Canada had been ratified. See announcement on page 81 of the A.S.M.E. News section of this issue of MECHANICAL ENGINEERING.

A Committee on Society Organization Structure had been set up with G. L. Knight as chairman. The function of the committee is to examine all Society committees and activities and report to the Council.

A Committee on Postwar Planning (see MECHANICAL ENGINEERING, December, 1943, page 853) had been appointed with E. G. Bailey as its chairman.

The Secretary read a letter he had written at the request of the Nominating Committee outlining his views on the qualifications of members of the Council. The letter was endorsed by the Executive Committee and by the Council.

ANNUAL REPORTS

The Council accepted the Annual Reports of Society Committees and adopted the Annual Report of the Council, which will be found in this issue of MECHANICAL ENGINEERING, pages 32–38.

KILGORE BILL OPPOSED

A special committee consisting of C. B. Peck and R. L. Sackett presented a report on the Kilgore Bill. The report was approved as a statement of the views of the Council on the Kilgore Bill. Copies were ordered sent to the local sections and to Senator Kilgore and the statement was transmitted to MECHANICAL ENGINEERING for publication (see pages 45–46 of this issue).

WOMAN'S AUXILIARY

The report of the Woman's Auxiliary was accepted and the Secretary was requested to express the appreciation of the Council to the Auxiliary for its work.

REVISION OF THE BY-LAWS

A proposed revision of the By-Laws relating to the election of honorary members was read and slated for second reading at the 1944 Semi-Annual Meeting.

REPORTS OF MEMBERS OF COUNCIL

Members of the Council reported on visits by them to local sections and student branches made since the 1943 Semi-Annual Meeting. It was the opinion of members who had been present at 1943 group meetings of local section delegates that these conferences were worth while.

RECONVENED MEETING

The Council reconvened on Monday morning following its informal meeting with members of the Group Delegates Conference and chairmen of standing committees that had been held on Sunday evening, reported elsewhere in this report. The thanks of the Council was voted to George T. Seabury and Howard F. Peckworth, of the American Society of Civil Engineers, for their explanation of the plans of A.S.C.E. in setting up collective-bargaining agencies for engineers.

CANONS OF ETHICS

D. C. Jackson, chairman of the E.C.P.D. Committee on Ethics, reviewed the status of the proposed canons of engineering ethics which had been recommended to the constituent bodies of E.C.P.D. for adoption. After extended discussion the Council voted to approve the E.C.P.D. Canons of Engineering Ethics in principle.

H. N. DAVIS TELLS OF TRIP TO LONDON

Harvey N. Davis, past-president, reported informally on general features of his recent trip to England on behalf of the Office of Research Production and Development.

It was reported by the Secretary that Dr. Davis had been elected an honorary member of The Institution of Mechanical Engineers and that H. V. Coes had been elected a member of the Institution.

R. B. GLASSCO, PAUL DUBOSCLARD, A. A. SCHWARTZ, AND L. BALBO

WILLIAM A. CARTER, W. M. SHEEHAN, AND C. W. GOOD

H. R. FLETCHER, R. F. FAY, F. E. HOLLIS, AND C. F. HARMES

STAFF MEMBERS HONORED FOR LONG SERVICE

When the Council convened for its final session of the Administrative year, on Friday morning, this time in the Council room of the Society's headquarters, ten members of the headquarters staff whose terms of service to the Society had exceeded 25 years were introduced by the Secretary with brief comments on the nature of the work they handled.

The staff members thus introduced were: Miss Francis Selig, Ernest Hartford, Frederick Lask, Miss K. W. Clendinning, Miss Louise Reinschmidt, Miss Jean Brown, Miss Marge Marty, C. B. Le Page, Miss Martha Jurist, and A. W. Schrage. President Coes greeted each staff member personally and added his expression of appreciation and thanks to the formal vote of the Council. A bonus check was handed by the President to each of these ten members of the staff. Miss Selig responded on behalf of her colleagues.

RESOLUTION OF THANKS

A resolution of thanks to all persons and agencies who had contributed to the success of the 1943 Annual Meeting was voted by the Council.

REGISTRATION OF ENGINEERS

For the Committee on Local Sections S. R. Beitler presented the suggestion of the Registration Committee that a digest of registration laws of the various states be prepared for publication in the Membership List, and that the student branches be encouraged to hold one meeting a year on the subject of registration. It was pointed out that the State of Wisconsin had published a digest of registration laws and that the size of this volume indicated that the proposed project would be expensive.

STANDARDIZATION OF STEAM TURBINES

K. M. Irwin presented a report of the Special Committee on Standardization of Steam Turbines which the Council received and voted to publish as preferred ratings and recommended practice and to refer it to the Standardization Committee for subsequent handling with A.I.E.E. and A.S.A. The Council voted to discharge the committee with cordial thanks and appreciation.

PETROLEUM COMMITTEE

On recommendation of the Committee on Professional Divisions it was voted to disband the Petroleum Division and to reorganize its activities under a committee of the Process Industries Division.

RAILROAD DIVISION

W. M. Sheehan called attention to conflicts between the dates of meetings of the A.S.M.E. and the Association of American Railroads and urged that attempts be made to avoid such conflicts.

METALS ENGINEERING DIVISION

Plans for the reorganization of the Metals Engineering Division were outlined by W. M. Sheehan.

GROUP DELEGATES CONFERENCE

C. C. Austin, speaker of the Group Delegates Conference, outlined the actions and recommendations of the Conference. The recommendations were referred to the Executive Committee, and the Council expressed its thanks and appreciation to the Group Delegates. (See pages 79–80.)

CARNOT BOOK

Copies of a new edition of Thurston's translation of Carnot's "Reflections on the Motive Power of Heat," were exhibited. The Council voted to express its appreciation to Robert H. Roy, member A.S.M.E., who had set the type of the book and carried out the details of its publication, and to the Waverly Press, Inc., publishers of the edition.

RESEARCH COMMITTEE

On behalf of the Committee on Research, Mayo D. Hersey called attention to the large amount of work under way and the limited personnel available to guide the work.

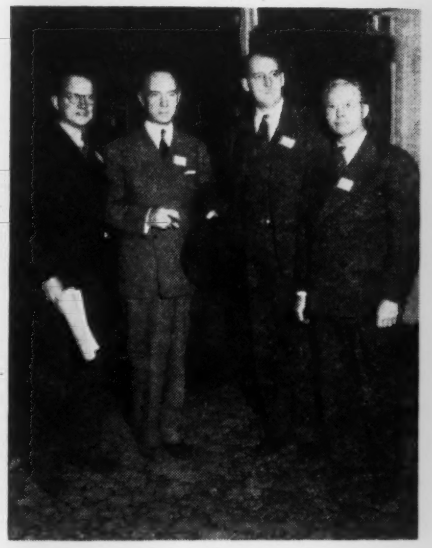
ADJOURNMENT

As its concluding action, the Council voted to express its deep appreciation to members whose terms were expiring. Mr. Coes added his own expressions of appreciation to those of the Council.

1944 COUNCIL CONVENES

Immediately upon the adjournment of the 1943 Council, Mr. Coes relinquished the chair to the incoming president, Robert M. Gates, who called the 1944 Council to order. The first action of the new Council was to express its appreciation to

PAST-PRESIDENT DEXTER S. KIMBALL, PAST VICE-PRESIDENT EUGENE W. O'BRIEN, AND LIEUT. COM. R. P. KOLB



R. L. PERRY, PAST-PRESIDENT WILLIAM A. HANLEY, ED S. SMITH, AND LINN HELANDER

H. W. R. WHEELER, VINCENT M. FROST, A. J. GERMAIN, AND STANLEY BROWN

Mr. Coes for the time and effort he had devoted to the Society and the Council.

The Council then voted the reappointment for the term of one year of Col. C. E. Davies as secretary of the Society, and of W. D. Ennis as treasurer.

The Executive Committee for 1944 was appointed as follows: R. M. Gates, chairman; W. J. Wohlenberg, vice-chairman; Alton C. Chick, D. W. R. Morgan, and A. R. Stevenson, Jr. Mr. Gates also asked Mr. Coes to sit with the Executive Committee during the year.

The entire list of committees and Society representatives was reviewed.

MEETING DATES APPROVED

The following meeting dates were approved:

1944 Fall Meeting, Cincinnati, Ohio, Oct. 2–5, 1944.

Annual Meeting, the week beginning Nov. 27, 1944, at the Hotel Pennsylvania, New York, N. Y.

Oil and Gas Power Division meeting, May 8–10, 1944, Tulsa, Okla.

GREETINGS TO P. B. EATON

W. G. Christy reported correspondence with Paul B. Eaton, former member of the Council, who is now in China on a mission for the Department of State. Mr. Christy was asked to extend the best wishes of members of the Council to Mr. Eaton, who had been designated an honorary vice-president of the Society during his stay in China.

EXECUTIVE COMMITTEE

Following the adjournment of the Council, the Executive Committee met to discuss its program for the administrative year.

TECHNICAL COMMITTEE MEETINGS

The technical sessions were paralleled this year by a group of 35 technical committee meetings. These meetings extended from Monday morning to Saturday noon. They were divided among the several groups as follows: Research, 12; Standards, 12; Power Test Codes, 7; and Safety, 3. The attendance at these meetings was exceptionally good. The total number present was 375.

THE RESEARCH GROUP

Twelve special and joint research committee meetings were held during the six days of Annual Meeting week. They were all well attended and in each case good progress was recorded. The Special Research Committee on Strength of Vessels Under External Pressure, F. V. Hartman, chairman, opened this group of meetings on Tuesday morning. Eleven were present and the meeting was given over largely to a discussion of the text of a proposed chapter in the revision of the Code on Unfired Pressure Vessels. This chapter is to cover the design, fabrication, and inspection of vessels subjected to external pressure. It will also include rules for the design of this type of ferrous and nonferrous vessels at elevated temperatures.

That afternoon the standing Committee on Research held its annual meeting. This is the meeting at which the chairmen of the special and joint research committees and the research secretaries of the professional divisions are invited to be present. In addition to the five members of the standing committee, 3 advisory members, 10 officers of the special committees, and 6 research secretaries were present. M. D. Hersey, chairman, presided and the reports of those present indicated a number of interesting developments and general increase in interest in research.

The secretary announced formally the appointment to the committee of Prof. George A. Hawkins by President Gates for the five-year term 1943–1948. The committee then elected Herman Weisberg to the chairmanship of the committee for the coming year.

Special notice was taken of the organization and progress of work of the Special Research Committee on Cutting of Metals and its several subcommittees and the standing committee decided to make some changes in the organization setup of this committee.

On Wednesday the Special Research Committees on Mechanical Springs, J. R. Townsend, chairman; Fluid Meters, R. J. S. Pigott, chairman; Boiler Feedwater Studies, Executive, C. H. Fellows, chairman; and Metal Cutting Data and Bibliography, M. Martellotti, chairman, held meetings at which principally routine business was transacted.

Tuesday morning three of the Society's research committees conducted technical sessions. The Committee on Metal Cutting Data presented two papers, one by F. W. Lucht on "Elements to Be Considered in Milling Steel With Cemented Carbide Tipped Milling Cutters," and one by O. W. Boston on "Proposed Standard of Tool-Life Tests for Evaluating the Machinability of Single-Point Tools, Cutting Fluids, on Materials Cut." F. J. Oliver, a third member of the committee, presided.

C. B. LE PAGE AND DR. SANFORD A. MOSS

L. J. FLETCHER

PRESIDENT-ELECT GATES AND PRESIDENT COES

The second technical session held under the auspices of this research committee was scheduled for Tuesday afternoon. It was called a Chip Control Symposium at which M. E. Lange presided. The panel consisted of four authorities in this field. Their prepared discussions are titled as follows: "Increasing Tool Life by Better Tool Finishing," by V. H. Ericson; "Chip Control With Sintered Carbide Tipped Tools," by M. F. Judkins; "Standardization of Cutting Tools Development of Fine-Finished, Single-Point Chip Breaker Type," by C. J. Wiberg; and "Chip Disposal Methods," by F. J. Oliver.

The third technical session on metal cutting was held that same evening at which three papers were read. W. C. DeGraff served as chairman and Hans Ernst as recorder. The papers read were by O. W. Boston, H. L. Moir, E. M. Slaughter, and W. H. Oldacre on "Practical Cutting Fluid Recommendations for Use With High-Speed-Steel Tools," a second by W. W. Gilbert and W. C. Truckenmiller on "Metal-Cutting Nomograph for Cutting Steel With Single-Point Tools;" and a third by Max Kronenberg on "Cutting-Angle Relationships on Metal-Cutting Tools."

The boiler feedwater studies session was held this year on Tuesday afternoon. Chairman C. H. Fellows was in the chair and Secretary J. B. Romer served as recorder. The one paper presented at this meeting was written by R. E. Hall. Its title is "A New Approach to the Problem of Conditioning Water for Steam Generation."

Four research committees held their meetings on Thursday. The Joint Research Committee on the Effect of Temperature on the Properties of Metals held its meeting in the morning with 19 present. The principal topic for discussion at this meeting was the graphitization of steel piping. This also was the subject of the committee's technical session held on Thursday afternoon. Chairman N. L. Mochel presided at that session and J. J. Kanter acted as recorder. The titles and authors of these papers are as follows: "Graphitization Caused by Testing Conditions on Carbon Molybdenum Tubular Creep Test Specimens," by H. J. Kerr and F. Eberle; "Carbide Instability of Carbon Molybdenum Steel Piping," by R. W. Emerson; and "A Possible Means of Avoiding Local Graphitization of Steels in Service at Elevated Temperatures," by G. V. Smith and R. F. Miller.

Special Research Committee on Lubrication, Dr. B. L. Newkirk, chairman, also held its meeting on Thursday morning. Routine business was transacted. This committee cooperated with the Applied Mechanics Division in setting up the program for a technical session held on Tuesday morning.

A very long meeting was held by the Special Research Committee on Plastic Flow of Metals, A. Nadai, chairman. This meeting began at lunch on Thursday and carried through the afternoon. It reconvened in the evening. Four of the items on the order of business were (*a*) report on the actions taken at the August, 1943, meeting of the committee; (*b*) outline of testing program on strength of welded and unwelded steels under combined stresses at normal temperatures; (*c*) plans for the studies on stress-strain relations in various drawing processes in progress at Case School of Applied Science under Prof. G. Sachs, and (*d*) investigation of friction under extreme pressures and at high temperatures.

The organization of one new special research committee was started on Thursday afternoon. The Steering Committee appointed by the Standing Committee on Research to draft a scope and recommended personnel of a new committee on "Diesel Engine Performance" held its first meeting at that time.

The new Special Research Committee on Furnace Performance Factors, A. R. Mumford, chairman, in its efforts to develop the literature on its problem co-operated with three of the professional divisions in developing the programs for three technical sessions. The session on Monday evening was under the joint auspices of the committee and the Power Division, at which three papers were read dealing with the performance of the 2500-psi boiler of the Twin Branch Plant. Prof. Theodore Baumeister and A. R. Mumford were the co-chairmen for this session which attracted an unusually large attendance.

The second technical session was arranged by the committee in co-operation with the Fuels, Power, and Heat Transfer Divisions. It took place on Wednesday morning and was presided over by E. G. Bailey. The titles and authors of the six statistical papers are as follows: "Furnace Design and Development of Steam-Generating Units Burning Central Illinois Coal," by J. R. Michel; "Collection of Data on Existing Installations," by Philip Sporn; "Pulverized-Coal-Fired Boiler Furnaces, Public Service Electric and Gas Company, New Jersey," by Herman Weisberg; "Description and Performance of Boilers 12 and 14, Trenton Channel Plant, and Boilers 9 and 10, Marysville Plant, of The Detroit Edison Company," by R. J. Brandon and W. A. Carter; "Statistical Information on Large Pulverized-Coal Units on Consolidated Edison System," by W. E. Caldwell; "Performance of Pulverized-Coal-Fired Boilers on Philadelphia Electric Company System," by J. H. Harlow. The papers mentioned were abstracted by A. R. Mumford who gave a résumé and the authors did not present

BRIG. GEN. CHARLES D. YOUNG TALKS ON RAILROAD MOTIVE POWER

M. F. JUDKINS READS HIS PAPER AT CHIP CONTROL SYMPOSIUM

LIEUT. COL. N. F. SILSBEE TALKS AT AVIATION LUNCHEON

their papers. The discussion at the session centered around the résumé by Mr. Mumford.

The same group of divisions co-operated with the committee in setting up the program for the third technical session held on Thursday morning at which E. B. Ricketts presided. The three papers presented at this session are by H. Kreisinger and R. C. Patterson on "Heat Transfer to Water-Cooled Furnace Walls," by John Blizard on "Absorption of Heat by the Walls of a Furnace," and by W. T. Reid and P. Cohen on "The Flow Characteristics of Coal-Ash Slags in the Solidification Range."

On Friday afternoon Chairman Mumford presided over a well-attended meeting of his Special Research Committee on Furnace Performance Factors. Obviously the principal subject of discussion was the use which the committee could make of the data presented at the three technical sessions.

At the Engineering Societies Building on Friday morning a new special research committee was formed to supervise the study of demolition bomb bodies. This is the second research project undertaken by the Society under a contract with the Ordnance Department of the U. S. Army. M. D. Stone was elected chairman, and W. O. Clinedinst, secretary, with W. Trinks as projects director.

The Special Research Committee on the Forging of Steel Shells held its technical session on Wednesday afternoon. Four papers were presented. The first by M. D. Stone on "The Flow-of-Metal Problems in Shell Forging," the second by W. Trinks on "Piercing of Steel Shells," the third on "Experimental Study of Shell Drawing," by George Sachs, and the fourth on "Plastic States of Stress in Curved Shells," by A. Nadai. W. F. Stevenson of the Ordnance Department presided.

The technical session on "High-Temperature-Steam Corrosion" scheduled for Tuesday morning was sponsored by the Special Research Committee on Critical Pressure Steam Boilers and the Power Division. Martin Frisch served as chairman and C. A. Kelting as secretary. The two papers read at this session were on "High-Temperature-Steam Corrosion Studies at Detroit," by I. A. Rohrig, R. M. Van Duzer, and C. H. Fellows, and on "The Corrosion of Alloy Steels by High-Temperature Steam," by G. A. Hawkins, J. T. Agnew, and H. L. Solberg.

Two technical sessions were sponsored this year jointly by the A.S.M.E. Standing Committee on Research. The first took the form of a production research panel and was sponsored jointly with the A.S.M.E. Manufacturing Engineering Committee. H. N. Davis and Erik Oberg presided as co-chairmen and C. L. Tutt acted as recorder.

The discussion was opened by prepared statements presented by Messrs. L. C. Morrow, C. D. Mercer, P. S. Criblet, A. A. Schwartz, and T. D. Perry. Each of these gentlemen gave in his own words an answer to the question "What Research and Development Is Most Needed in the Production Field?"

The second general session on production-engineering research was sponsored jointly with the Production Engineering Division. At this session Messrs. R. W. Dayton, C. H. Lorig, and E. R. Adams read a paper on "Wear-Resisting Materials for Lathe Construction," and Earle Buckingham's paper on "Surface Fatigue of Plastic Materials" which is in the nature of a progress report of the Special Research Committee on Strength of Gear Teeth, was presented in the author's absence by G. J. Taldbourdet.

STANDARDS GROUP

This group of technical-committee meetings was opened by the annual meeting of the standing committee on Monday morning. In the unavoidable absence of L. T. Knocke, chairman, Dr. T. E. French presided. The agenda for the meeting consisted principally of secretary C. B. LePage's annual report and routine business. One important item in the secretary's report was the statement that during the Society's fiscal year eleven standards had been completed or revised and transmitted to the American Standards Association. It was reported also that at the time of the meeting four additional standards had been completed by the sectional committees and were passing through the final approvals required in the procedure of the A.S.A.

The progress made by the other standards committees for which the Society is sponsor or joint sponsor is recorded in the standing committee's annual report which is published as a part of a separate pamphlet available on application to A.S.M.E. headquarters.

The election of the new chairman of the committee was another item on the order of business. The secretary called for nominations and Dr. T. E. French was nominated and unanimously elected chairman for the year 1943–1944. The committee was then informed that President-Elect R. M. Gates had approved its recommendation for the appointment of D. S. Ellis as the 1943 addition to the committee's personnel.

The largest group of standards committees to hold meetings this year is that organized by the Sectional Committee on the Standardization of Small Tools and Machine-Tool Elements, B5, of which W. C. Mueller is chairman and P. L. Houser is

secretary. In all, seven meetings were held including the annual meeting of the sectional committee.

Twelve attended the meeting of Technical Committee No. 9 on Punch Press Tools of which C. D. Carter is chairman. A thorough discussion was had of the draft proposal now before the committee and it was decided to make some radical changes in it.

The largest meeting of this group was that of Technical Committee No. 13 on Splines and Splined Shafts, S. O. Bjornberg, chairman. Good progress was reported by three of the subgroups on straight, involute, and aircraft involute splines. Draft standards of these proposals may be expected during the coming year.

At the meeting of Technical Committee No. 10 on Forming Tools and Holders, W. C. Mueller, chairman, the comments were reviewed that had been received from industry in response to the general distribution of a tentative draft of a proposed American Standard for "Straight Cut-Off Blades for Lathes and Screw Machines." These were generally favorable. So, when certain slight changes and additions are made, the proposal will be sent to the members of Sectional Committee B5 for vote on approval.

A new technical committee of B5 to be known as "Technical Committee No. 23 on Machine Pins" was formed at a meeting held on Tuesday afternoon. P. L. Houser is to serve as chairman of this new technical committee. G. W. Metz was elected to the secretaryship.

Twelve attended the meeting of Technical Committee No. 21 on Tool-Life Tests for Single-Point Tools, O. W. Boston, chairman, held on Wednesday morning. Professor Boston reported at the subsequent meeting of Sectional Committee B5 that his technical committee had completed its work on high-speed steel tools and had covered its findings in a technical paper presented to the Society on Tuesday morning under the title "Tool-Life Tests." At this meeting plans and a test method were completed for evaluating cemented-tungsten-carbide tools.

Thursday afternoon was the time set for the annual meeting of Sectional Committee B5. At this meeting the sectional committee receives the reports of its technical committees which have been active during the last year. Twenty six attended this meeting and three hours were given to the routine business which developed from the annual reports of the twenty-three technical committees made at that time.

The new Subcommittee on Scope and Intent of the Sectional Committee on a Code for Pressure Piping, B31, held its first meeting on Tuesday afternoon. Sabin Crocker is chairman of this subcommittee.

The third meeting of the Joint Conference Committee on Piping Codes and Standards was held on Tuesday evening with C. A. Kelting, chairman, presiding and J. W. Shields acting as secretary. The members of this joint committee were named by the A.S.M.E. Boiler Code Committee, Sectional Committee B16, and Sectional Committee B31.

On Wednesday afternoon the Subcommittee on Wire and Sheet-Metal Gages held a meeting which had been called by Chairman J. R. Townsend. At this meeting the progress made in the acceptance of the American Standard for Preferred Thicknesses for Uncoated Thin Flat Metals (Under 0.250 In.), B32.1-1941 was reviewed. The subcommittee then agreed to recommend the use of the decimal sizes in inches corresponding to the Brown & Sharpe gage numbers in specifying round copper wire and it plans to request its members in the steel industry to recommend a series of decimal sizes for steel wire.

During this week on Wednesday, Thursday, Friday, and Saturday a series of conferences on pipe threads, screw threads, and cylindrical tolerances and fits were held in New York, N. Y., the first three in the Hotel New Yorker and the last in the Engineering Societies Building. These conferences had been called by a committee appointed by Howard Coonley, chairman of the Combined Conservation Committee of the United Kingdom and United States. They were attended by the three members of the British Mission, Messrs. Percy Good, S. J. Harley, and F. W. Elstub and large delegations of American manufacturers and users of these products. At these conferences the British and the American practices in each field were thoroughly reviewed and helpful suggestions were exchanged by the two groups. At the close of each of the four conferences those present expressed the hope that further negotiations on the four subjects would be held in the future.

POWER TEST CODES GROUP

Seven meetings were held by this group during the week. The standing Committee held a general session on Friday morning and an executive session on Saturday morning. Chairman F. Hodgkinson presided at the first and Vice-Chairman A. G. Christie at the second.

Committee No. 2 on Definitions and Values, R. J. S. Pigott, chairman, led off with a meeting on Monday morning. It is expected that this meeting will result in the completion of the revision of the supplementary publication on "Definition and Values" in power tests.

Two meetings of this group came on Wednesday afternoon. Prof. M. C. Stuart's Committee No. 10 on Fans met to complete the editing of the proposed A.S.M.E. Test Code on Fans. Paralleling this meeting was a large meeting of Committee No. 4 on Stationary Steam-Generating Units, E. R. Fish, chairman. At this meeting finishing touches were put on the Test Code for Coal Pulverizers and the revision of the Test Code for Steam-Generating Units. Both of these codes were presented to the standing Committee on Power Test Codes during its meeting on Friday morning.

On Thursday morning the Committee on Hydraulic Prime Movers No. 18 held its annual meeting. The principal business of this meeting was a discussion of a progress report of its subcommittee on two-type-current-meter test. That gave the comparative curves between the two-type-current meter and the Gibson test. The general nature of the report was that the two methods were in substantial agreement in the upper range of the test. Committee No. 18 requested a formal report of this subcommittee to be made available not later than April 15, 1944.

An all-day meeting of the Joint A.I.E.E.-A.S.M.E. Committee on Specifications for Prime Mover Speed Governing, M. J. Steinberg, chairman, was held on Thursday. The joint committee reviewed at this meeting the "Recommended Specification for Prime-Mover Speed Governing" which had been presented to the Society for general discussion at a technical session held on Wednesday afternoon and the comments which had been presented at that session. The program of the meeting listed this session as a "Panel Discussion on Recommended Specification for Prime-Mover Speed Governing of Steam Turbines." The program of the session, at which Mr. Steinberg presided, consisted of formal papers by Messrs. A. F. Schwendner, R. Sheppard, E. E. Parker, and J. B. McClure; and a general discussion which was participated in by a group of twelve co-operating experts.

SAFETY GROUP

Three meetings were held during the week by the committees which have developed the American Standard Safety Code for Elevators, Dumbwaiters, and Escalators (A17.1-1937 with 1942 Supplement) and the American Recommended Practice for the Inspection of Elevators, Inspectors' Manual (A17.2-1937).

On Wednesday morning the Subcommittee on Inspectors' Manual, K. A. Colahan, chairman, held its meeting and eight members were in attendance. It carefully considered the criticisms and comments received as a result of the circularization of an earlier draft of the proposed revision of the Manual and many of the suggestions were accepted. Some of the revisions in the text resulted from changes made in the Elevator Code by

the issuance of the 1942 Supplement. The new material added consists of sections under "Routine or Periodic Inspection" and under "Original or Data Inspection" covering escalators. The greatly increased use of such equipment during the past few years has made the addition of this material most desirable. Considerable material included in the four maintenance bulletins prepared by the Executive Committee during the past year has been included also under appropriate paragraphs.

The following day, Thursday, the members of the Executive Committee, D. J. Purinton, chairman, met and there were six members present. The revised draft of the Manual submitted by the subcommittee was reviewed and approved for submission to the members of the Sectional Committee.

Eleven were present at the meeting of Sectional Committee A17 held on Friday morning. Sullivan W. Jones presided and John A. Dickinson, who is secretary for this committee as well as the two just mentioned, served in this capacity. It received the reports of the Subcommittee on Inspectors' Manual and the Executive Committee. However, the principal item on the order of business was the Inspectors' Manual. Those in attendance gave careful consideration to the latest draft of the proposed revision and approved it for presentation to the entire membership of the Sectional Committee for vote on approval by letter ballot prior to submission to the three sponsor organizations and the American Standards Association.

PLANT VISITS

A Plant Inspection Committee, headed by George J. Nicastro, chairman, arranged six plant visits during the week of the 1943 Annual Meeting.

On Monday the laboratory of the Buell Engineering Company, 611 Broadway, was shown to A.S.M.E. visitors by Joseph A. Messenger, member A.S.M.E., vice-president and general manager.

At the plant of the American Sugar Refining Company, Brooklyn, N. Y., visited on Tuesday afternoon, F. M. Gibson, member A.S.M.E., chief engineer, acted as host.

The Queens Midtown Tunnel was visited on Wednesday afternoon.

William M. Schuler, member A.S.M.E., plant superintendent, Jacob Ruppert, showed members through the Ruppert Brewery on Thursday afternoon.

Friday's visit was to Parkchester, a community within the city of New York, covering 129 acres and consisting of 58 buildings.

An opportunity to visit Aberdeen Proving Ground, Ordnance Department, at Aberdeen, Md., was afforded members on Saturday following the meeting. Major General Charles T. Harris, commanding officer of Aberdeen Proving Ground, acted as host.

COLLEGE REUNIONS

In accordance with the practice of former years, several groups of alumni of universities and engineering colleges held "reunions" in connection with the 1943 Annual Meeting.

On Thursday evening, December 2, the Brown Alumni met with the Brown Engineering Association at its annual meeting.

The Purdue Club held its "Purdue-A.S.M.E. Presidents' Night" on Thursday evening.

Reunions scheduled for Friday included those of the Cornell Society of Engineers, the Harvard Engineering Society, the "Mechanical Alumni" of Pratt Institute, Rensselaer Alumni Association, the Alumni Association of Stevens Institute of Technology, and Yale University.

The Brooklyn Polytechnic Alumni Association scheduled its "Get-together" on Thursday, December 9.

CREDIT GOES TO THE COMMITTEES

Although the thanks of all members and guests are due to the numerous speakers and authors of technical papers, and to the chairmen of sessions at which these persons appeared, all of whom have been included in resolutions passed by the Council and members in attendance, a considerable portion of the credit for the most successful and largest of all A.S.M.E. meetings must be given to the many committees on whom fell the burdens and responsibilities of arranging and carrying out the details of the programs.

Prominent among these committees must be mentioned the Committee on Meetings and Program, on which the major task of preparation and operation falls. The chairman of this committee is Nevin E. Funk, with whom served L. K. Sillcox, F. G. Switzer, R. A. North, and D. S. Walker, with Irving Taylor, junior adviser to the committee.

Special committees, made up of members of the A.S.M.E. Metropolitan Section, on whom fell much of the detail of the meeting, were as follows.

RECEPTION: T. B. Allardice, chairman, Theo. Baumeister, W. L. Betts, F. P. Brand, H. C. R. Carlson, F. D. Carvin, E. V. David, Adolf Ehbrecht, R. W. Flynn, C. F. Foell, V. M. Frost, W. S. Gleeson, G. E. Hagemann, C. A. Hescheles, G. G. Hyde, H. R. Kessler, J. H. Krooss, J. N. Landis, W. H. Larkin, H. E. Martin, A. R. Mumford, G. J. Nicastro, A. L. Nicolai, P. T. Onderdonk, W. S. Patterson, C. B. Peck, A. M. Perrin, P. B. Petty, William Raisch, H. F. Ritterbusch, J. H. Sengstaken, M. S. Symon, H. C. Wilcox, and F. L. Yerzley.

DINNER AND HONORS NIGHT: H. G. Ebdon, chairman; P. W. Foster, Jr., vice-chairman; H. R. Kessler and W. H. Larkin, seating; E. W. Legier, ushers; S. H. Libby, "Old Guard," J. H. Sengstaken, music and dancing; and Mrs. F. M. Gibson, Jr., "asKme."

TECHNICAL SESSIONS: E. E. Jackson.

PLANT TRIPS: G. J. Nicastro, chairman, N. J. Connor, J. C. Falkner, R. W. Flynn, F. M. Gibson, H. H. Johnson, and J. N. Landis.

JUNIOR GROUP ACTIVITIES: Charles H. Carman, Jr., chairman.

STUDENT AIDES: J. G. Barrie, G. F. Kayan, C. H. Kent, K. J. Moser, K. E. Quier, W. A. Vopat, and H. E. Walter.

WOMEN'S EVENTS: Mrs. J. N. Landis, general chairman; Mrs. G. E. Hagemann, vice-chairman; Mrs. F. M. Gibson, registration; Mrs. E. B. Smith, publicity and printing; Mrs. R. B. Purdy, Annual Luncheon; Mrs. F. M. Farmer and Mrs. C. M. Sames, Monday Tea hostesses; Mrs. H. R. Kessler, excursions; and Mrs. F. M. Gibson, Jr., "asKme."

ERNEST HARTFORD, EXECUTIVE ASSISTANT SECRETARY, A.S.M.E.

S. D. MOXLEY, R. A. NORTH, AND NEVIN E. FUNK

BRIEFING THE RECORD

Abstracts and Comments Based on Current Periodicals and Events

MATERIAL for these pages is assembled from numerous sources and aims to cover a broad range of subject matter. While few quotation marks are used, passages that are directly quoted are obvious from the context and credit to original sources is given.

Method of Aircraft Propulsion

SPECIAL CORRESPONDENCE

THE efficiency of the conventional screw propeller drops off appreciably when the speed of forward flight combined with high speed of revolution brings the tip speed close to or above the speed of sound. The difficulty is increased when operating at high altitudes where the speed of sound is lower than at sea level. Another difficulty which great altitudes introduce is the difficulty with which power is absorbed by the propeller when operating on air of very low density. The power of the engine may be sustained at sea-level value by supercharging, but to absorb this power may become extraordinarily difficult. Variation in pitch may not suffice, and variable-speed gearing and variable-diameter propellers may become necessary.

The realization of these difficulties has led many workers to the contemplation of jet propulsion akin to rocket propulsion in which exhaust gases would issue through a nozzle in the combustion chamber and produce thrust by simple reaction or exchange of momentum. The internal efficiency of the jet-propulsion engine would be very high—eventually much higher than that of the gasoline engine or the Diesel engine. But disregarding the metallurgical and other difficulties involved, there is one very serious obstacle: To produce any reasonable specific power for a given size and weight of engine, the jet must issue at tremendously high velocities. When the velocity of the jet is very high in relation to the velocity of the vehicle, the external propulsion efficiency is very low, as has been amply demonstrated in fluid and applied mechanics. To improve the external efficiency, it would be necessary to add air to the jet by an "augmentor" so as to decrease the velocity of the jet after air and exhaust gases had combined. Such augmentors have so far proved completely unsatisfactory.

Now there has been suggested by Ernest Lagelbauer of New York, N. Y., a novel system of direct or jet propulsion, in which, however, there is possibility of removing the difficulty cited.

Mr. Lagelbauer terms his system the "Direpeller." Reduced to its simplest terms, the theory of the Direpeller may be stated as follows: A jet of high-velocity combustion gases is projected at right angles to an air stream which is produced by the forward motion of the aircraft. The combustion gases combine with the air stream and the momentum of the gas jet is communicated to a much greater mass of air. Subsequently, by the use of suitable guide vanes, the angular momentum produced is converted into linear momentum and since the issuing jet of air and burned gases is much slower than the jet would be if acting by itself, the external efficiency should be much greater than that of the jet-propulsion device acting on the simple, straight-line rocket principle.

There follows the schematic description of the device.

In flight the relative air stream passes through a tubular element, the "Direpeller" tube (see Fig. 1). The air stream is given some degree of transverse acceleration by deflector vanes, but strong angular momentum is produced by the direct impact of the power jet of combustion gases, augmented by air introduced and intermingling with the power jet by contour and injector action. The gas jet enters the Direpeller tube in a transverse plane, chordwise and nearly tangentially. Subsequently, after passing through a so-called momentum exchanger or equalizer and through the rectifying blading, the combined air and gas jet exists with only a translational velocity. The method of converting angular momentum into thrust is roughly illustrated in Fig. 2. The resultant of the longitudinal components of the pressures exerted upon all the blades is the desired thrust. Transverse pressure components result in a moment which is to be compensated for by appropriate design of the aircraft or by the arrangement of another Direpeller tube with rotation in the opposite direction. A distributor wheel is indicated to give an essentially uniform flow through the entire air stream.

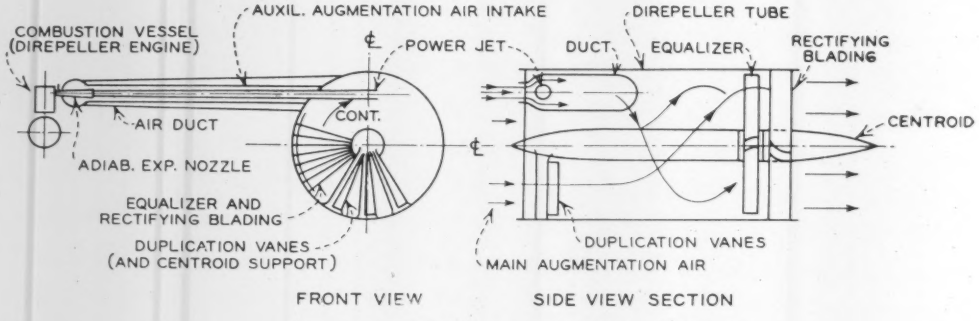


FIG. 1 DIREPELLER ASSEMBLY, DIAGRAMMATIC

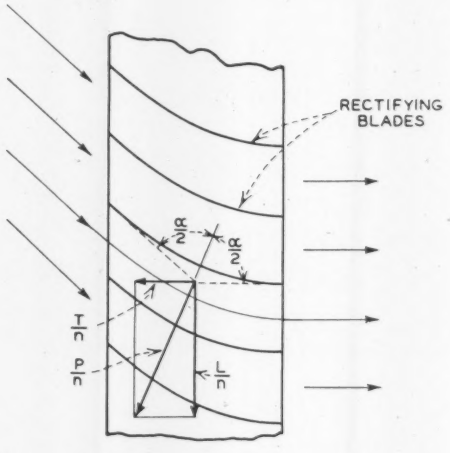


FIG. 2 DIREPELLER WITH MOMENTUM EXCHANGER

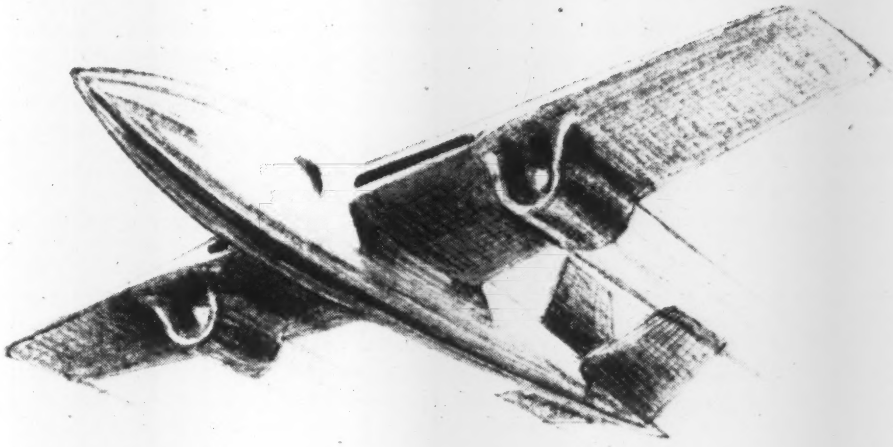


FIG. 3 DIREPELLER APPLIED TO AIRPLANE

With respect to the conversion of the heat of combustion of the fuel into kinetic energy of the power jet, two alternative schemes come into consideration. One of these methods is the continuous, whereby combustion takes place in a specialized combustion vessel into which the fuel and the air are introduced under the pressure of combustion. Therefore an individual air compressor is required. The other method is intermittent, similar to the conventional reciprocating internal-combustion engine, with the distinction that most of the energy released during combustion is converted into kinetic energy by means of a valve-controlled adiabatic nozzle while only a fraction of it is transmitted to the crankshaft with the object of precompressing the combustible mixture or the combustion air, according to the power cycle employed. The primary advantage of the intermittent method is that the design of the machine is nearly identical with the ordinary gasoline or oil engine, and so a great part of the design data is available.

Mr. Lagelbauer has made preliminary computations on a number of assumptions which need the most careful verification and therefore are not yet in such form that they can be published. It is therefore impossible at the moment to form a definite idea of the quantitative efficiency of the device. An artist's sketch, Fig. 3, gives something of the imaginative realization of the proposal.

Synthetic-Rubber Products

METROPOLITAN SECTION, ASME

WHEN the Baruch Rubber Committee convened in the fall of 1942 it found a program under way which contemplated a production in the United States of 877,000 long tons of synthetic a year, said Chris Kurzweil, Mystik Adhesive Products Company, in a paper before the Rubber and Plastic Division of the A.S.M.E. Metropolitan Section, New York, N. Y., from which the following has been condensed. After completing a thorough study of the problem, the committee recommended an expanded program as follows:

	Program August, 1942	Additional recommended capacity	Total
GRS—Buna-S	705,000	140,000	845,000
GRM—Neoprene	40,000	20,000	60,000
GRI—Butyl	132,000	...	132,000
Totals	877,000	160,000	1,037,000

Since the Baruch Committee made its recommendations there have been several unforeseen developments which necessitated a reduction in the originally planned capacity of the synthetic polymerization and copolymerization plants. The development of a severe shortage of critical components, including valves, turbines, pumps, motors, heat exchangers, and the like, made more critical by an expanding demand for these components by the Army and Navy for the high-octane gasoline, and Navy convoy-vessel programs, all contributed to the necessity for the program cutback.

According to the latest available figures the present government program has set capacities as follows:

Buna-S (GRS) 735,000 long tons; Butyl (GRI) 68,000 long tons; Neoprene (GRM) 40,000 long tons; a total of 843,000 long tons.

This is approximately 194,000 tons under the Baruch recommendations. However, most Neoprene and Buna S plants, now in production, are running over their rated capacity and this is expected to offset some of the reduced volume. The Butyl synthetic plants are having some difficulty at present in meeting their rated capacity of Butyl to government specifications, but the technologists seem to feel that their problems will be solved shortly and these plants will be producing at least at rated capacities.

There are two other sources of rubber we can depend on. The rubber-reclaiming industry will produce over 300,000 tons of reclaimed rubber in 1944 and crude-rubber imports for next year are estimated at 180,000 long tons. A study of these figures indicates therefore that the engineer will now have sufficient rubberlike materials to work with to satisfy the essential civilian needs and the expanded war needs of ourselves and our allies, but many finished-product problems remain to be successfully solved.

The normal world consumption of crude rubber in peacetime is approximately 1,200,000 tons and of this, the United States consumed approximately 650,000 tons. Abnormal world consumption is expected, however, for three or four years after the war, amounting to 1,500,000 long tons needed to build up depleted stock piles of raw materials and manufactured products as well as to satisfy new markets and product-development demands.

The potential rubber production in the Far East is estimated at 1,600,000 long tons. Price will be a determining factor in synthetic postwar competition with natural rubber. Natural rubber is now cheaper, but postwar plantation costs will be higher and research will reduce the cost of synthetic and create new specialized synthetics with certain properties superior to rubber. The Japanese will probably destroy plantation equipment rather than the trees and a year should bring back normal crude production after recapture. The Japanese are probably getting most of their needed rubber from Indo-China. Therefore, Sumatra, Malaya, Borneo, and Java should give a flush postwar yield to offset any destruction.

None of the man-made rubberlike materials is true rubber, as none is identical in chemical structure with natural rubber. However, all possess some of the physical properties of natural rubber and in addition usually have some outstanding property

not found in natural rubber, making them superior for certain uses. The United States Rubber Company has published a booklet on synthetic rubber which explains the chief differences between natural and synthetic rubber.

Natural rubber exceeds all of the synthetics in resiliency. Natural rubber is likewise superior in tensile strength, resistance to plastic flow, and tear resistance, which are all important considerations in the design of rubber products. The inferior resiliency of the synthetics and a corresponding higher hysteresis loss in conjunctuon with lower tear resistance, particularly at elevated temperature, offer the most serious problems to the product designer where these are a factor, as in certain tires, transmission belts, and many highly stressed mechanical parts.

Certain synthetics, however, can be made to equal natural rubber in extensibility, electrical properties, and in abrasion and cold resistance. Others can be compounded to exceed natural rubber in impermeability to gases and heat resistance. At least one of the synthetics exceeds rubber in applications where chemical resistance is an important design factor. It should also be remembered that greater chemical resistance helps maintain more uniform physical properties, thereby increasing the useful life of the product. Certain synthetics can be blended with each other, with reclaimed rubber, or, if necessary, with some natural rubber to overcome their lower physical properties, and these blends will retain certain superior chemical properties. Engineers should not consider synthetic rubber as a single new engineering material but rather as a wide variety of rubberlike engineering materials with tremendous possibilities in the engineering field.

Fuel Conservation Program

W. P. B. AND ELECTRICAL WORLD

WHATEVER the long-range fuel situation in this country may be, there is real need for conservation of all types of fuel in the immediate future. A bulletin of the War Production Board says that, with the war approaching a decisive stage, the need for conservation has become more urgent than ever before.

Although the savings in a single household, commercial establishment, or industrial plant may seem insignificant, the possible aggregate savings are tremendous. It is estimated, for example, that a 10 per cent reduction in domestic and commercial use of coal for heating would save over 20,000,000 tons annually; a 10 per cent reduction in domestic and commercial use of electricity would save over 4,000,000 tons of coal and more than 75,000,000 lamp bulbs; a 10 per cent reduction in the use of manufactured gas would save over 1,500,000 barrels of fuel oil. In addition, vast quantities of other critical materials and manpower would be released.

Unfortunately, the initiation of this program came at a time when the public interest was largely centered in the progress of the military campaign in Italy. Announcements of it were pushed onto the back pages of the papers. Furthermore the Army and Navy departments canceled the dimout regulations on the Atlantic, Pacific, and Gulf coasts as of Nov. 1, 1943. This was done, it is understood, to reduce the greatly increased hazard to human life resulting from reduced highway lighting.

In any event, the net effect in the coastal regions was to convey the impression that the lid was off so far as lighting was concerned. Power companies have tried to counteract this impression without much success. An editorial in the Nov. 13, 1943, issue of *Electrical World* says:

"Nothing is more thankless than trying to get people to do something they don't want to do. Such is the situation that exists today with respect to voluntary conservation of electricity to save coal and transportation.

"The greatest savings will have to come from reduced usage by merchants and electric-sign users. They are willing to turn out their lights if all the others do, but where there is lack of compliance, not only locally but elsewhere, they balk.

"One cannot help being understanding of that point of view, yet one must not let one's feelings get the better of one's judgment. Conservation is necessary and the work of convincing customers of this need must go on.

"Most utilities have made an honest effort to secure compliance, although a great many have underestimated the amount of effort necessary to make the program succeed. In far too many instances the management's heart was not in the job, and the employees who were contacting the commercial customers have been reflecting this attitude. Obviously, when lip service only is given, the customer not only loses interest but, if there is any criticism for noncompliance, he blames the utility. This has happened in a number of cases.

"Today the voluntary program is in jeopardy and, regardless of who is to blame, the censure is being and will continue to be heaped upon the electric power industry simply because it cannot hide noncompliance."

How Much Oil Have We?

VARIOUS SOURCES

PREDICTIONS of an impending oil shortage in the United States have been made from time to time over a period of many years. Until recently these predictions have always been vitiated by the discovery of new oil reserves. From 1934 to 1938, for example, new oil reserves were discovered at an average rate of 2000 million barrels per year as compared with an annual consumption of about 1250 million barrels per year. Since 1938, however, there has been a sharp drop in the discovery of new oil fields. In 1942, the new reserves discovered amounted to less than 300 million barrels. Meanwhile the consumption had jumped to 1400 million barrels. Thus there has been for several years a definite depletion of oil reserves.

These conditions have resulted in a growing number of new warnings that our oil resources will not last forever. At a joint meeting of the A.S.M.E. and the A.I.M.E. at Pittsburgh, Pa., on Oct. 29, 1943, Robert M. Weidenhammer, president, Cosgrove Coal Company, estimated that we have enough oil to last only about 14 years, though we have enough coal to last at least a thousand years. Natural-gas supplies will last for about two generations, he said. Water power, while it may appear inexhaustible, can supply economically only a small part of the national energy requirements. Hence the main reliance will eventually be on coal.

An article in the November issue of *Industrial and Engineering Chemistry*, by Per K. Frohlich, president, American Chemical Society, supports the viewpoint presented by Mr. Weidenhammer. Nobody knows definitely how much oil remains in the fields that have been discovered, or how much of it can be brought to the surface. The proved reserves, he said, correspond to about 15 years' consumption at the prewar rate. Accelerated wartime demands, however, have led to a rate of withdrawal higher than normal. It is certain, he thinks, that eventually a shortage in natural petroleum will occur. When that time comes it should be possible to meet demands for gasoline and other hydrocarbon products from other sources such as shale oil and coal.

Harold L. Ickes, Solid Fuels Co-Ordinator for War and Secretary of the Interior, pointed out in an article in *Coal Age* a few months ago that the present known reserves of oil are only 13 to 14 times the present annual consumption, or, in other words, that the supply is insufficient for more than 14 years unless important new fields are discovered. Actually the known reserves cannot be withdrawn at a uniform rate until they are exhausted. It is likely, he said, that it will take 50

ESTIMATED MINERAL-FUEL RESERVES OF THE UNITED STATES

(R. M. Weidenhammer)

	Original reserve	Reserve, Jan. 1, 1942	Production, 1941	Exhaustion, per cent
	Billions of tons			
Anthracite	22	15	0.056	32
Low-volatile bituminous coal	56	53	0.101	5
High-volatile bituminous coal	1379	1353	0.398	1.9
Subbituminous coal	819	818	0.012	0.1
Lignite	940	939	0.003	0.1
Total, all ranks of coal	3216	3178	0.570	1.2
	Billions of barrels			
Petroleum proved reserve	45	20	1.404	56
Oil in oil shale	92	92	0	0
	Trillions of cubic feet			
Natural gas, proved reserve	135	85	2.770	38

years to empty all the known petroleum reservoirs. This means that a diminishing rate of production will be experienced in much less than 14 years.

Possibilities of discovering new sources of oil are discussed in the October *Industrial Bulletin* of Arthur D. Little, Inc. It is explained there that the most promising locations where oil might be expected to be found have already been explored. It is entirely possible, of course, that additional oil may be discovered in places which geologists do not regard as likely, but the prospects are not particularly encouraging. Generally speaking, about one well in 20 drilled at random has produced oil as compared with one in five drilled on the basis of technicological information.

Another possibility is deeper drilling. New resources of oil have recently been found in Louisiana at a depth of more than 2.5 miles. This is far deeper than the average depths of discoveries in recent years, which have ranged from 3700 ft to about 5000 ft. There is also a possibility that additional oil can be obtained from existing wells by pumping in gas instead of relying on natural pressure to bring the oil to the surface.

The recovery of oil from shale and hydrogenation of coal represent other possible means of meeting the situation. The Bureau of Mines has carried on extensive experiments with respect to means of obtaining oil from shale. The reserves of oil shale, measured in heat units, are said to be about five times those of natural petroleum. How much it would cost to get the oil from the shale is not definitely known. One of the problems in this connection is that most of the known oil-shale deposits are in Utah and Colorado. Rather heavy freight charges would thus be involved in the transportation of shale oil to the centers of population in the East.

Hydrogenation of coal might go a long way toward meeting the country's needs for hydrocarbon products. Little has yet been done along that line in the United States, although plants have been in operation for some time in Germany and England. In fact Mr. Ickes estimates that more than one third of the German military requirements are being met in this way. He therefore recommended to Congress that legislation be passed authorizing the construction of at least one pilot plant here. On Nov. 9, 1943, the Senate approved a bill appropriating $30,000,000 for this general purpose.

It is not the part of wisdom, he said, with petroleum reserves running low, to sit idly twiddling our thumbs. Common sense demands that we take positive action.

The whole situation was summarized in a talk by Ralph A. Sherman, supervisor, Fuels Division, Battelle Memorial Institute, before the Chicago Section A.I.M.E. on Oct. 17. He referred to a statement by Dr. Gustav Egloff, director of research, Universal Oil Products Company, who contends that nature is producing petroleum faster than we are consuming it. Despite such optimistic statements Mr. Sherman believes we should conserve our petroleum resources.

"We have within our territorial borders," he said, "ample reserves of fuel to maintain and to expand our industrial civilization both for the present and for the distant future. The problem before us is to apply each type of fuel—oil, natural gas, and coal—to the use to which each is best suited. Fuel for the internal-combustion engine and fuel for the generation of heat can be made from petroleum, from natural gas, or from coal, but the costs for plant, for labor, and for raw materials differ widely.

"Sound national policy demands that we conserve our reserves of petroleum for the production of motor fuel and for our Navy and that we apply coal to those uses which it can serve

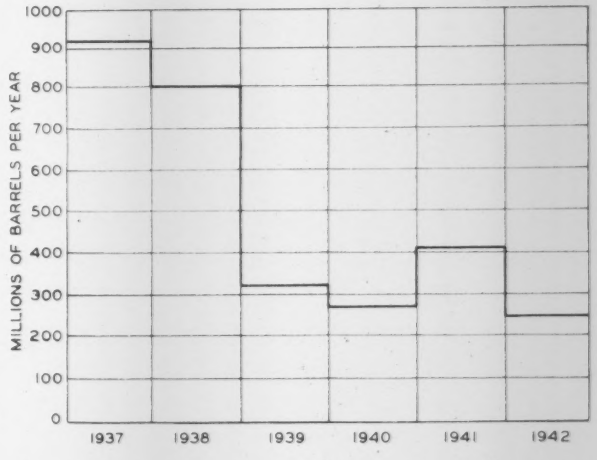


FIG. 4 RATE OF DISCOVERY OF NEW OIL RESOURCES (A.P.I. DATA)

equally as well as oil. Let us put off for as long as possible the day when we must pay the cost of conversion of our coal reserves to liquid fuel.

"For coal to take over the fields of use of oil and natural gas in comfort heating, in steam generation, and in metallurgical processing requires only that the proper equipment for its use be provided. A great deal of that equipment is now available, and other equipment is in the process of development, but much equipment is still lacking and its development will require extended research in the future. The equipment manufacturers can be relied upon to carry on development research and the bituminous-coal and anthracite industries are now supporting centralized programs of research to insure not only their own future but the future comfort, well being, and progress of this country."

Improvements in Streetcars[1]

AMERICAN TRANSIT ASSOCIATION

TEN years have elapsed since the first streetcars of this so-called "Presidents' Conference Committee" type were placed in service. There have been numerous minor improvements added annually since the original order for PCC cars in 1935. There have, however, been no radical innovations, except in the cars built for the St. Louis Public Service Company, where an electrically operated drum brake on the drive shaft was substituted for the air brake.

Several months ago, work was started on a study of the entire design of the PCC car with the object of incorporating improvements indicated to be desirable from a ten-year experience. The viewpoint behind this work on the PCC car is that nothing

[1] Condensed from an article by A. H. Leschke in the Oct. 29, 1943, issue of *Passenger Transport*, published by the American Transit Association.

must be overlooked which will improve the performance of the car, facilitate passenger movement, and contribute to passenger comfort. The only limitation is the cost of incorporating every practicable feature that will contribute such benefits. The PCC car as it exists is much smoother and quieter in performance than was ever considered possible for a streetcar; yet it is now recognized that further improvement is both desirable and possible.

The objectives of the work can be resolved into six major considerations:

1 Passenger convenience and comfort—which includes the question of improved heating and ventilation.
2 Greater reliability—through more rugged simplified design and improved materials.
3 Further elimination of objectionable noise.
4 Improved exterior and interior appearance.
5 Reduction in weight and cost.
6 Lower maintenance and operating cost.

In order better to visualize and study various changes which have been suggested in the car body, a full-size mock has been built. Its appearance does not differ radically from the present vehicle. Experiments are being conducted to determine how these objectives can most effectively be attained.

Gas Turbines for Locomotives

RAILWAY FUEL AND TRAVELING ENGINEERS ASSOCIATION

NO marked progress has been made during the year in the development of a gas turbine for locomotives, according to a report submitted by L. P. Michael, member A.S.M.E., chairman, committee on gas-turbine-powered locomotive, Railway Fuel and Traveling Engineers Association. This committee for several years has been endeavoring to promote the design and development of a high-powered locomotive of a type which could be constructed in one unit with the prime mover and all accessories contained in one cab carried on two trucks having all the axles and wheels of both trucks power-driven. The gas turbine, requiring no water for its operation, has been considered as the ideal means of accomplishing this purpose. A number of gas turbines are under construction in this country for government projects, but none has yet been built for commercial purposes. It is thought that the developments along these lines will eventually be of real value in the design of a gas-turbine locomotive.

Estimates have been made by the committee that a direct power transmission for the contemplated type of locomotive would weigh between 20 and 25 per cent less than any electrical transmission that could be installed. A satisfactory type of universal joint is held to be essential for mechanical transmission. The report of the committee mentions the favorable characteristics of the Bendix-Weiss joint which is used on some of the so-called PCC streetcars, on warships, jeeps, half tracks, amphibians, and a variety of other vehicles used by the United States, Canadian, and British armies.

Gas Turbines for Ships[1]

THE SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS

IN 1939 the gas turbine appeared to be no more than a utopian scheme for the future; in 1943 many engineers feel convinced that gas-turbine plants can be designed which will offer serious competition to other power devices. The idea of the gas turbine is not new, but progress in metallurgy has greatly increased its practicability.

Once the obstacles associated with any new development of this kind are overcome, the gas turbine is expected to be as suitable for continuous-duty marine service as the steam turbine. The maintenance problem should be equivalent to that of turbine installations and much more favorable than that of Diesel engines.

The starting problem is in process of rapid evolution, and it is somewhat difficult to predict the final solution. European practice has solved the problem by auxiliary electric motors or Diesel engines. This is an awkward approach in that it introduces other prime movers quite often of considerable size. One promising scheme is to start the plant on air bottles, following conventional Diesel practice. These bottles can be charged by bleeding the main compressor, or by a small auxiliary pump. Computations, not yet substantiated by experiments, for a 2500-horsepower plant indicate that about 5 pounds of air at 80 pounds per square inch is sufficient for one start.

The reheat plant with constant-displacement compressors is subject to control down to less than 10 per cent load. For still lower loads, a partial by-pass of the power turbine can be adopted, thus approaching the conditions of starting operation. It would appear then that satisfactory control for ahead operation is a practical possibility.

The problem of astern operation is more complex. With the many mechanical problems yet to be mastered, it would appear unwise at present to attempt reversing by the conventional means of an astern turbine. When a satisfactory variable-pitch propeller, or a reversible gear, becomes available a direct-geared drive for gas turbines will be the solution. In the meantime, hydraulic or electric drives would have to be used. Both can be made to give satisfactory maneuvering and reversing characteristics.

[1] Condensed from a paper presented by C. Richard Soderberg and Ronald B. Smith at the Annual Meeting of the Society of Naval Architects and Marine Engineers, Nov. 11-12, 1943.

Wartime Population Shifts

THE BUREAU OF URBAN RESEARCH, PRINCETON UNIVERSITY

SOME cities have lost population during the last couple of years while others have had remarkable increases in spite of loss of men to the armed forces. According to a survey by the J. Walter Thompson Company, New York and Boston have had substantial losses, while Detroit, San Francisco, Oakland, Los Angeles, Washington, Norfolk, Portsmouth, Newport News, St. Louis, San Diego, Baltimore, and Seattle have gained from 100,000 to nearly 400,000.

These increases, however, appear unlikely to be permanent.

READINESS FOR MIGRATION OF WORKERS IN EIGHT CITIES

	In case of unemployment		
	Move away, per cent	Stay here, per cent	Uncertain, per cent
Portland (60%)[a]	57	43	..
Mobile (75%)	49	45	6
Los Angeles (46%)	39	55	6
Wichita (40%)	38	58	4
Atlanta (20%)	37	61	2
Pittsburgh (36%)	33	63	4
Buffalo (54%)	23	54	23
Detroit (24%)	13	80	7

[a] Percentages of those interviewed in each city who have moved to that city since February, 1940.

An article by Jerome S. Bruner, associate director, Office of Public Opinion Research, Princeton University, appearing in a recent issue of the *American Journal of Sociology*, presents the results of an investigation of war workers' "readiness for migration" in the postwar period. It is based on public-opinion polls taken among male workers in eight widely scattered war-production centers.

Generally speaking the war workers were pessimistic about their chances of holding their jobs after the war. The highest percentage of readiness for migration exists in shipbuilding cities, next highest in aircraft towns, and least in steel and automotive centers. Less than half of the migrant groups that moved into war-work areas within the last three years plan to move after the war. The places from which people migrated before the war can count on only a 45–55 per cent population return after the war. Selective Service figures indicate also that approximately 50 per cent of the Army personnel are ready to move to new centers after the war.

What Is Gold Worth?

THE INDUSTRIAL BULLETIN OF ARTHUR D. LITTLE, INC.

THE world's annual gold production is a little over 1000 tons, of which 900 to 950 tons are immediately reburied in governmental treasuries, which now hold some 30,000 tons. With government price support withdrawn, the price should fall sharply, and with it production, but the amount then economically usable by industry might be far larger than it is.

Gold is too scarce ever to be cheap; its industrial use must be based on its unusual properties. Although gold is dissolved by *aqua regia* (a mixture of nitric and hydrochloric acids), it resists all other chemical agents except elementary chlorine and fluorine, by which it is slowly attacked. It is the most malleable and ductile of all substances: One ounce can be beaten into 250 square feet of gold leaf. Particularly important is the fact that it can be fired firmly onto porcelain, glass, etc., to form a fast joint. Another unusual property is ability to weld to itself and to other metals at ordinary temperatures by pressure alone. Finally, gold is one of the easiest metals to heat, cool, or melt in terms of heat required.

Present industrial uses of gold include gold-platinum alloys for viscose rayon spinnerets; gold-palladium-iridium-platinum alloys in thermocouples designed for extremely accurate temperature measurement; and such therapeutic applications, in addition to dental work, as use of gold-silver alloy plates for repair of skull injuries, permanent insertion of gold capsules containing radioactive substances in malignant neoplasms, and the treatment of arthritis and tuberculosis with gold salts. Electrical equipment for measuring aircraft speeds includes a tiny motor generator with 15-karat gold wire in the generator brushes.

Prospects for the Gas-Turbine Locomotive

JOURNAL OF THE INSTITUTE OF MECHANICAL ENGINEERS (LONDON)

THE history of the gas turbine locomotive is outlined by Adolf Meyer in the November, 1943, *Journal of the Institution of Mechanical Engineers* and its future prospects are evaluated. In weighing the economic value of the gas-turbine locomotive, he says, it is best to consider the subject first from the point of view of traffic density, which is the determining factor of any traction system. If a dense traffic has to be dealt with, full electrification will always receive the first consideration. Wherever the course is justified, any other form of locomotive is immediately excluded.

Coal cannot yet be employed as a fuel for the gas-turbine locomotive. This fact restricts its use to countries in which oil occurs, or in which oil can be obtained relatively easily and cheaply. To such lands might be added those where considerable developments are expected in the near future in the conversion of coal to oil, motor spirit, and other valuable products, instead of burning it directly. There may, however, also be other reasons in favor of the use of oil instead of coal such, for instance, as the desire to avoid polluting the atmosphere with smoke and ashes, a condition which has in fact, in certain large cities, resulted in legislation forbidding the use of coal for locomotives.

In countries rich in oil resources, or where oil is readily available and is even used for firing steam locomotives, the reduction of the oil consumption to a little more than half is likely to be a deciding factor in favor of the gas-turbine locomotive.

Considerable saving is also realized in lubricating-oil costs, as experience shows that the consumption of lubricants of the purely rotating machinery is extremely small, whereas according to American authorities the lubrication costs of steam locomotives amount to 10 per cent of the fuel costs. The corresponding figure in the case of the gas turbine may be taken as less than 1 per cent.

A further advantage of the gas-turbine locomotive, doubly reflected in the operating costs, is the absence of any water. This does away not only with the necessity of having to carry a supply of water (up to 100 tons is carried in modern American locomotives), but also with all the arrangements for procuring, delivering, purifying, and softening the water required. The absence of water is also very noticeable in the maintenance, and accordingly results in increased availability since there are no interruptions for cleaning or repairing boilers.

The Philosophy of Aviation

(Continued from page 14)

. Collective action would be organization of the United Nations to maintain peace and cooperate in solving world-wide problems. Unquestionably, the United States, Britian, Russia, and China would tend to dominate such an organization because they would furnish its main support. But in an organization including other powers and regional groups, smaller nations would make a valuable contribution in both force and statesmanship.

The organization of the United Nations should be brought into being now. The cohesive forces among the United Nations; our common cause, common enemy and the urgent necessity of cooperating to win the war, are dominant now and will remain so as long as we fight. But thoseforces will be weakened or disappear as soon as victory is won and other forces—nationalism, economic rivalries, and petty differences—tending to drive the allies apart will gain strength, making united action more difficult.

I subscribe to Senator Ball's premise that plans for such international collaboration should be initiated now, particularly in regard to the postwar aviation situation. If we adopt a policy of waiting it can only contribute to the confusion that is certain to follow the victory, unless understanding in regard to world-wide air routes is now established. I hope this can be done because if the United Nations cannot collaborate in the peace as they have in the war then I am fearful we have done nothing but lay the foundation for World War III.

It was Plutarch who said, "Nothing is easier than to fancy systems for the happiness of nations and nothing more difficult than to realize them." The air-transportation industry has no panacea for all the world's ills, but it has certain definite contributions it can make for human betterment. This can be done if our government is willing to substitute co-operation for paternalism and allow free enterprise in our industry to prosper. Aviation has proved its worth in this war and if properly nurtured can prove its worth in peace, and I believe our government is quite cognizant of that and will give the co-operation we seek.

Could aviation speak as an individual, its philosophy would be: "I can annihilate space and time; to do this I must be understood; I must be used to supplement other forms of transportation; I must be nurtured and not whipped. I can promote understanding among peoples; I can be the implement of peace, prosperity, and happiness for all."

COMMENTS ON PAPERS

Including Letters From Readers on Miscellaneous Subjects

Gasket-Loading Constants

COMMENT BY KARL SIEMON[1]

In the article[2] presenting gasket-loading constants, the authors publish a list of gasket factors, which presumably will supersede the gasket factors contained in Tables UA-7A and B of the 1942 Addenda of the A.S.M.E. Unfired Pressure Vessel Code. They further invite a discussion of gasket factors and gasket problems in general.

With the exception of the factors for solid-metal gaskets, on the average, the new values amount only to 50 to 60 per cent of the present Code figures. Since no concrete new experimental results are given to justify this change, the question arises: Where do we stand now? Unfortunately, it is difficult to make an intelligent appraisal of the situation, because the experimental, documentary, or theoretical basis, from which the gasket factors were derived, has never been published in any one of the representative American engineering journals.

If the authors really desire to promote the discussion of gasket problems, and the publication and correlation of test data and operating records, it seems only fair that they should set a good example by revealing the methods used for determining the gasket factors and by publishing experimental records and other sources upon which the data in Tables UA-7A and B are based. This would enable other engineers to make tests of their own and to prove by their own experience whether the data of the Boiler Code Committee are correct or not. Suppose tensile-testing machines were not known and the yield point of metals had not been clearly defined. If somebody should then publish the bare figures of the yield points of a number of aluminum and copper alloys, without the least bit of description of his methods and would ask for comments, could he expect to receive more than a general response?

The authors admit that there are some flaws in their gasket factors. This has always been apparent in the design of low-pressure installations, where flange thicknesses were obtained far in excess of those which had previously given satisfactory service. In the medium-pressure range, the results seemed to conform better with operating experience, but this did not necessarily mean that the most economical design was obtained, and that the gasket factors in Table UA-7 actually represented optimum values.

Experimental evidence produced by other investigators further indicates that the gasket-loading "constants" are subject to variation in several respects and are therefore not constant at all. Without any further explanation by the authors, there is no way of knowing whether such variations developed in the experiments of the Boiler Code Committee or whether they were neglected as part of the "extreme simplification of a rather complex problem."

Sooner or later it will probably be necessary to set up testing procedures for gaskets, as has been done for other materials. A uniformity of procedure would also greatly facilitate the correlation of experiments by different investigators. It seems that the A.S.M.E. Boiler Code Committee would have the power, if not the obligation, to take the first step in this direction and to provide a basis for further discussion by disclosing the procedure used in determining the gasket constants. As part of this program, some of the terms used in the Code would have to be more precisely defined. What, for instance, in exact physical terms, is the yield point of a gasket, and when is a gasket considered as seated?

Furthermore, it might be expected that a greater amount of data could be made available for study and subsequent addition to the gasket rules in the Code, if this phase of the work of the A.S.M.E. Boiler Code Committee were placed on a broader basis. Gaskets are so widely used, that they are of concern to a great many different industries and engineers. The types, materials, and operating conditions of gaskets are so manifold that it takes years of specialization and intensive study to acquire a fair knowledge of the whole field. Gasket failures may cause the loss of lives and property. The authors themselves emphasize the great complexity of the problem and the great amount of work to be done in order to advance our knowledge of gasket problems. And yet, the actual work on gaskets in the A.S.M.E. Boiler Code Committee seems to be carried out by only two or three of its members, mainly representatives of equipment manufacturers, for whom gaskets are only of secondary interest.

While due credit is to be given to the authors for the great amount of work obviously done in compiling the gasket data and for the ingenuity displayed in the approach to the subject, it seems logical to expect that it would relieve some of their burden and expedite the solution of the many problems if gasket manufacturers would receive a direct voice in the deliberations of the Committee. It is therefore suggested that either the proper Subcommittee of the A.S.M.E. Boiler Code Committee be expanded by the addition of two gasket engineers, or that a separate body be created under sponsorship of the A.S.M.E. for dealing with gasket problems, in which all interested would be adequately represented.

Until the situation has been clarified and until gasket theory has been more consolidated, it does not seem to be advisable to change the existing gasket and flange rules or to add new ones.

COMMENT BY H. H. DUNKLE[3]

The further subdivision of Table A to include a broader range of gasket designs and materials, and the recognition of the effect of gasket thickness, should lead to a more extensive use of the values presented. The breakdown of Table B into two sections in an attempt to account for the variations in the manner in which soft and hard gaskets perform, and the addition of an empirical formula, evaluating the effective-width factor, are constructive steps in the right direction.

It has been the writer's experience that a further definition of some of the yield values would be advisable in order to account for differences introduced by standard commercially available modifications of several of the designs presented. For example, the corrugated-metal gaskets are normally supplied with a corrugation pitch of $1/4$ in. It is to be assumed that the values given in Table A refer to gaskets of this construction. Since a wider or narrower pitch would have a distinct

[1] Engineer, Bakelite Corp., Bound Brook, N. J. Mem. A.S.M.E.

[2] "Gasket-Loading Constants," by D. B. Rossheim and A. R. C. Markl, MECHANICAL ENGINEERING, September, 1943, pp. 647–648.

[3] Research Engineer, Goetze Gasket & Packing Co., New Brunswick, N. J. Mem. A.S.M.E.

effect upon the stiffness of the gasket and hence upon the yield stress required, it is suggested that the specifications be stated for designs normally subject to such variations in construction features.

Extensive experimental work on the determination of the yield value for numerous gasket designs has led the writer to the conclusion that this factor is subject to far too many variables to be reduced to such relatively simple terms as are presented by the authors. Furthermore a study of the scanty literature on gasket investigation does not reveal any data that conclusively prove the existence of a yield point.

Undoubtedly flow and hence yield of the gasket or flange contact faces must take place in order to obtain a seal; but once yielding has been initiated, it will continue to take place as long as the load on the gasket is increased. The stress required to initiate yielding will not always be sufficient to enable the gasket to withstand internal pressure. On the other hand the ability of the gasket to hold pressure does not manifest itself suddenly at any definite stress but increases gradually as the stress increases. Slope changes in the curves, plotted on a basis of initial gasket stress versus internal pressure (neglecting the hydrostatic end force), do not necessarily designate a yield of the gasket in the sense used here but may be the result of shifting of the point of load attack, collapse of the gasket, increase in contact area, or similar factors.

It may be assumed that the yield values, presented by the authors in Table A, have been modified by the addition of a suitable safety factor and are therefore not directly comparable with the results of experimental or field tests. The use of a safety factor, in addition to the fact that bolt stresses are not readily applied with any degree of accuracy (unless checked for elongation), probably accounts in part for the reasonably satisfactory results, except in borderline cases, experienced by users of these values.

In view of the fact that yield values appear to be too indefinite and subject to too many unpredictable variables to be determined with any approach to accuracy, particularly if held to the limits of the code definition, the writer suggests for discussion a modification of the existing gasket-loading constants and the addition of a third constant.

It is a well-confirmed but little publicized fact that all gaskets will perform in a more consistently uniform manner and at considerably lower bolt stresses if they have been precompressed or seated at a stress higher than that actually required to initiate or maintain a tight joint. Precompression should be considered as a temporary stress to be imposed at the time of make-up of the joint and to be wholly independent of the operating conditions. It would appear that in amount, the precompression stress should be approximately double the yield value given in Table A and should be subject to modification by the width and facing factors of Table B.

The use of a precompression stress would eliminate the need of a yield value as such in the calculation of flange stresses. Rather, a minimum required stress, based on the assumption that the gasket has been precompressed, might be substituted to cover the design of joints in which the pressure factor alone would be insufficient to insure maintenance of a seal under operating conditions.

Experimentally the determination of precompression stresses is relatively simple and does not appear to be influenced to any appreciable extent by the minor variables that help to confuse yield-value investigations. Furthermore, the application of precompression stresses should result in better agreement in the gasket-loading-constant data originating from different sources.

AUTHORS' CLOSURE

The response to the authors' plea for a broad discussion of the subject of gasket-loading constants has proved disappointing, and the hope that information would be forthcoming to support or refute the published values for specific conditions has not been realized.

As with all involved subjects, where well co-ordinated data are lacking, progress in the establishment of suitable gasket-loading constants must of necessity be attained in small steps. The first significant advance was the publication of Table UA-7, which has gained widespread usage in spite of certain shortcomings. The modifications suggested by the authors were intended to remove some of the inconsistencies between that table and service experience; emphasis has been placed on operating data rather than tests since the latter, even if they were much more numerous and better co-ordinated, can be expected to serve only as a limited basis for comparison, particularly where they are confined to hydrostatic pressure and room temperature. Concerted committee action (with gasket manufacturer representation, as suggested by Mr. Siemon) has been tried by setting up a subgroup on gasket factors in the original Special Committee for Rules on Bolted Flanged Connections, but this was dissolved because of lack of achievement. Experience indicates that adequate and proper gasket factors cannot be expected to emanate entirely from either committee activities or manufacturers' tests; instead, real progress will always be measured by general interest and mutual co-operation of those directly engaged in design and, with this in mind, the authors continue to hope that engineers whose attention is attracted by this discussion will be prompted to read the original paper and submit such service experience as they may have in their own field.

We have already commented on Mr. Siemon's thoughts regarding the desirability of forming a special gasket committee. Regarding the remainder of his lengthy discussion, we find it lacking in useful comment. We should, however, correct Mr. Siemon's implication that the authors speak for the Special Committee on Rules for Bolted Flanged Connections; the modified table presents no more than the authors' private adaptation of Table UA-7 for use in their own organization.

We concur with Mr. Dunkle that the term "yield value," carried over from metallic gaskets, is somewhat of a misnomer. As used, it defines the minimum gasket loading which has to be applied initially in the cold state to produce a tight joint in a commercial gasket; it is intended to take care of precompression and, if properly selected, should avoid the necessity for introducing an additional constant, such as suggested by Mr. Dunkle.

D. B. ROSSHEIM[4] AND A. R. C. MARKL.

Shell Forging on Bulldozers

COMMENT BY R. A. MITCHELL[6]

In our French extrusion method of shell forging[7] as practiced by the writer's company, we have changed the second operation to a combination draw and pierce. The blank in the first operation is pierced to within approximately 1/4 in. of the required bottom thickness. In the second operation, the blank is shoved through a draw ring into a cup die where the bottom thickness is correctly attained. This operation also smooths out nearly all of the roughness left by the original piercing punch. Thus we obtain three distinct features: Longer life on first piercing punch; correct base thickness of the shell blank; we have only to contend with concentricity of one punch and die, due to heat expansion.

The author's conclusions concerning this method coincide with our own opinion. We have made the smaller mortar shells experimentally this way, and have concluded that the method can be adapted to all sizes and shapes of shells.

In the near future we hope to obtain

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[5] M. W. Kellogg Company, New York, N. Y.

[6] Vice-President, Pittsburgh Forgings Company, Coraopolis, Pa.

[7] "Shell Forging on Bulldozers," by W. Trinks, MECHANICAL ENGINEERING, September, 1943, pp. 639–642.

sufficient data on the power required to manufacture various-sized shells by this method, to be able to present a comprehensive report on the advantages and disadvantages of this method.

Design Engineer and His Status

TO THE EDITOR:

In the October issue of MECHANICAL ENGINEERING the Society has dealt with many subjects bearing upon the economic and social welfare of the engineer.

The reference to the organization of a "supersociety;" the praise of the *Economist* in its particular field together with the interrelationship of finance and engineering; the comments on pending patent legislation; and finally the formation of a special design group within the Society, which particularly appeals to me, seem very timely. As a design engineer, and like many another, I have felt too often that the creative side of engineering, or the design engineer as an individual, owing possibly to his absorption in the technical phases of his job, becomes particularly prey to exploitation by the so-called business or production side of engineering.

Opinion expressed in the magazine affirms a widely held belief that engineers as a body are insufficiently represented in the realm of legislation and in financial or business control. During this war period and of government more or less by fiat, when might makes right, the weakness of the engineering position becomes evident when it is realized that the creative and development side of engineering is entirely subordinated to that of production, under the rather hazardous conviction that safety lies primarily in great numbers and not in specific application.

It would seem that some representative engineering body outside the field of management or production is entirely necessary if the engineer is to attain his full status in the field of factual analysis, which is his particular bent, and if we as a nation are to keep our proper place in the world of affairs by intelligent control.

In regard to the co-ordination of the engineering profession, so interestingly referred to on the "President's Page" and in reference to which concrete suggestions are invited, I would like to suggest:

That the co-ordinated body organize under its control a legalistic board of arbitration, entirely free from management or business control, to which questions or problems bearing on the economic or professional status of the engineer may be submitted and from whom appropriate action may be expected. This board to be either an elective body, elected by the rank and file of engineers from within their ranks, or a body of recognized practicing engineers appointed by the president. This board should have power to influence legislation and should receive support for collective bargaining in the economic field.

The weakness of the engineer and of the profession is that he or it has no well-defined status such as you will find in medicine and in law and that he is almost completely inarticulate when decisions affecting his status or his work are being made. His work may be taken for granted, generally accepted, admired or praised, but the engineer as an individual or as a group is forgotten as such, unless he has erred, and his work is relegated as a business accomplishment of the concern that employs him.

While I cheerfully agree with any expressed wish that the engineer as an individual should conduct himself with proper modesty and self-effacement, I also believe that we should guard with jealous right the recognition of his efforts if only to prevent some alien breed from unduly feeding and fattening on the results of his accomplishments.

W. J. LEVERIDGE.[8]

[8] Tuckahoe, N. Y.

A.S.M.E. BOILER CODE

Interpretations

THE Boiler Code Committee meets monthly for the purpose of considering communications relative to the Boiler Code. Anyone desiring information on the application of the Code may communicate with the Committee Secretary, 29 West 39th St., New York, N. Y.

The procedure of the Committee in handling the cases is as follows: All inquiries must be in written form before they are accepted for consideration. Copies are then sent by the Secretary of the Committee to all the members of the Committee. The interpretation, in the form of a reply, is then prepared by the Committee and is passed upon at a regular meeting.

This interpretation is later submitted to the Council of The American Society of Mechanical Engineers for approval after which it is issued to the inquirer and published in MECHANICAL ENGINEERING.

Following is a record of the interpretations of this Committee formulated at the meeting of October 15, 1943, subsequently approved by the A.S.M.E. Council.

ANNULLED CASES

Case Number	Paragraph Revised
892	P-197(a), U-38(a)
925	S-12 (SA-95)
945	SB-171
950	P-102(h), U-68(h)
953	P-102(h), U-68(h)
955	P-108(c), U-76(e)
958	SA-106
962	P-23, U-20
969	P-300
971	P-105(c), U-74
975	P-299(e)
976	P-102(h) (1a), U-68(h) (1a)
977	SA-226
980	Tables P-5, P-7, U-2, U-2½
982	P-17, U-17, L-17
983(1)	SA-261
984	EA-A70, EA-A89
990	S-63, SA-251
992	P-102(g), U-68(g)
993	U-72(f)
995	Fig. UA-3(10)
996	P-102(h), U-68(h)
998	U-69(a)
999	SA-214

CASE No. 981 (*Reopened*)

(*Special Ruling*)

Inquiry: Is it permissible to use the following A.S.T.M. Emergency Alternate Provisions affecting existing Code specifications: EA-A27(S-11), EA-A70(S-1), EA-A83(S-17), EA-A89(S-2), EA-A135 (S-58), EA-A158(S-34), EA-A178(S-32), EA-A192(S-40), EA-A194(S-51), EA-A206 (S-45), EA-A209(S-48), EA-A213 (S-52), EA-A216(S-56), EA-217(S-57), EA-A226 (SA-226), EA-A240(S-62), EA-A249 (S-64), EA-A250(S-65), EA-B62(S-46), EA-B111(S-47), EA-B171(SB-171)?

Reply: It is the opinion of the Committee that the aforementioned A.S.T.M. Emergency Alternate Provisions in the corresponding Code specifications may be considered as meeting the intent of the Code.

CASE No. 1003

(*Interpretation of Par. P-290*)

Inquiry: Do the last two sentences of Par. P-290(*a*) apply to a steam scrubber or drier?

Reply: It is the opinion of the Committee that the requirements of the last two sentences of Par. P-290(*a*) need not apply to a steam scrubber or drier provided the net free steam inlet area of the scrubber or drier is at least 10 times the total area of the inlets for the safety valves.

CASE No. 1004

(*Interpretation of Par. P-186(b)*

Inquiry: In the construction of loco-

motive-type boilers may radiographic examination of the welded joint between the outside wrapper sheet and the outside firedoor head, as well as the welded joint between the outside wrapper sheet and throat sheet (straight vertical parts only), be omitted as provided in Par. P-186(*b*) if the distance from weld to first row of staybolts is within the permissible staybolt pitch of Par. P-199(*a*)?

Reply: It is the opinion of the Committee that the welded joints referred to in the inquiry do not come under the provisions of Par. P-186(*b*) and, therefore, are subject to the other provisions of the Code which require radiographic examination.

Revisions and Addenda to Boiler Construction Code

IT IS the policy of the Boiler Code Committee to receive and consider as promptly as possible any desired revision of the rules and its codes. Any suggestions for revisions or modifications that are approved by the Committee will be recommended for addenda to the code, to be included later in the proper place.

The following proposed revisions have been approved for publication as proposed addenda to the code. They are published below with the corresponding paragraph numbers to identify their locations in the various sections of the code and are submitted for criticism and approval from anyone interested therein. It is to be noted that a proposed revision of the code should not be considered final until formally adopted by the Council of the Society and issued as pink-colored addenda sheets. Added words are printed in SMALL CAPITALS; words to be deleted are enclosed in brackets [ ]. Communications should be addressed to the Secretary of the Committee, 29 West 39th St., New York 18, N. Y., that they may be presented for consideration.

PAR. P-101(*c*). Revise to read:

(*c*) UNLESS SPECIFICALLY PROVIDED OTHERWISE IN THE CODE, the tests conducted by one manufacturer shall not qualify a welding operator to do work for any other manufacturer. No production work shall be undertaken until both the procedure and the operator have been qualified.

PAR. P-112(*e*). Revise to read:

(*e*) Th manufacturer OR CONTRACTOR shall be responsible for the quality of the welding done by his organization.

WELDING PROCEDURES SHALL BE QUALIFIED UNDER THE PROVISIONS OF SECTION IX. THE MANUFACTURER OR CONTRACTOR [he] shall EITHER conduct tests [not only] of the welding PROCEDURE [process] to determine its suitability to insure welds which will meet the required tests, OR HE MAY USE AN ESTABLISHED PROCEDURE WHICH HAS BEEN PREVIOUSLY QUALIFIED BY OTHER THAN HIS OWN ORGANIZATION [but also of the welding operators to determine their ability to apply the procedure properly].

WELDING OPERATORS SHALL BE TESTED IN ACCORDANCE WITH THE PROVISIONS OF SECTION IX. A MANUFACTURER OR CONTRACTOR SHALL EITHER CONDUCT TESTS TO DETERMINE THE ABILITY OF A WELDING OPERATOR TO PROPERLY APPLY THE PROCEDURE, EXCEPT THAT WHEN ONE OR MORE MANUFACTURERS OR CONTRACTORS USE AN IDENTICAL WELDING PROCEDURE WHICH HAS BEEN QUALIFIED, HE MAY, WITHOUT REQUALIFICATION, USE AN OPERATOR WHO HAS BEEN PREVIOUSLY QUALIFIED UNDER SUCH A PROCEDURE BY OTHER THAN HIS OWN ORGANIZATION SUBJECT TO THE PROVISIONS OF PAR. Q-211.

WHEN certified by the manufacturer as applying to a given PROCEDURE [process] and TO [by] a given operator, [in accordance with the procedure in Section IX of the Code] the qualification tests [of operators] may be accepted by an authorized inspector [upon the results of the tests conducted by the manufacturer and].

An authorized inspector shall have the right at any time to call for and witness tests of the WELDING PROCEDURE [process] or of the ability of any welding operator. It is not necessary for the inspector to witness the welding of the test welds or the tests of such welds.

FIGS. P-21(*f*) AND U-3(*f*). Add the following note:

Note: t_s may be taken as the required thickness of a seamless shell when computing t_1.

ALTERNATE RULES, FUSION-WELDED BOILERS

Alternate rules for the construction of fusion-welded boilers are given in Pars. P-400 to P-409, inclusive, which permit liberalization of design stresses and welded joint efficiencies under certain restrictive construction rules which must be met in order to use the higher stress allowances. These rules apply only to fusion-welded or seamless drums, and to such detailed parts of boilers as are specifically named in the rules. Other applicable provisions of the Code must be complied with in all respects not specifically covered by these alternate rules.

P-400(*a*) Welded or seamless drums, shells, headers, and heads of power boilers, with a thickness not exceeding $^1/_2$ in., shall be designed using formulas in Pars. P-180, P-195, P-198, and P-268(*a*), with maximum design stresses given in Table P-7, and, if welded, a joint efficiency of 95 per cent may be used.

(*b*) Welded or seamless drums, shells, headers, and heads of power boilers with thicknesses exceeding $^1/_2$ in. may be constructed under the additional restrictions imposed in Pars. P-401 to P-406, inclusive, by using the formulas of Pars. P-180, P-195, and P-268 with the maximum design stresses given in Table P-7 multiplied by 1.25 and with 0.10 in. added to the calculated thickness, and, if welded, a joint efficiency of 95 per cent may be used.

P-401. Where plates of unequal thicknesses are abutted, the thicker plate shall be reduced by a taper of not less than 4 to 1 to equal thickness with the thinner plate. All other joint details shall conform to Par. P-104. After building up the weld reinforcement required by Par. P-105(*a*), the reinforcement shall be removed flush with the surface of the plates joined.

P-402. Stresses due to hydrostatic head shall be taken into full account in determining the thickness to be used, also the total of other stresses due to loads such as the weight of drums, tubes, water, and distances between drum supports, if these stresses increase the average stress over substantial sections of the shell or head by more than 10 per cent.

P-403 (*a*) For heads, the increased design stresses authorized in Par. P-400(*b*) may be used only for flat heads or for hemispherical or ellipsoidal heads with pressure on the concave side.

(*b*) The following heads and other parts shall not be designed under these alternate rules, but may be used with shells which are constructed according to them:

(1) Dished heads, other than hemispherical or ellipsoidal;

(2) All unstayed dished heads with pressure on the convex side;

(3) Ellipsoidal heads with flanged-in and other unreinforced manholes;

(4) All stays, braces, and parts requiring staying.

P-404(*a*) Openings in the shell which require reinforcement under Par. P-268 shall have the reinforcement applied equally on the inside and outside of the shell. If not so applied, the amount of reinforcement shall be calculated for a required shell thickness using design stresses from Table P-7. Openings in the heads may have the reinforcement on the outside only.

(*b*) In determining the maximum size of an unreinforced opening under Par. P-268(*a*), the value of K to be used in connection with the chart in Fig. P-35 shall be 1.1 times the value of K computed by the formula of that paragraph for the part of the shell that contains the opening. When computing K by the formula in Par. P-268(*a*), the pressure P shall be that for which the boiler is designed, S shall be 1.25 times the value from Table P-7, and t shall be the ac ual full thickness of the shell at the location of the opening, including the 0.10 in. additive thickness. Where K so computed is unity or greater, the maximum size of unreinforced opening shall be 2 in.

P-405. For pressures of 400 lb or over, the feedwater and lower water column connections shall be provided with shields, sleeves, or other suitable means to reduce the effects of temperature differentials.

P-406. In addition to stress-relieving requirements of Par. P-108, vessels shall be allowed to cool slowly in a still atmosphere to a temperature not exceeding 600 F.

P-407. The maximum allowable working pressure for tubes for water tube boilers built under these alternate rules may be determined by multiplying the stress value in the formula accompanying Table P-2 by 1.25, but from the pressure so calculated, 30 psi shall be deducted.

The maximum allowable pressures for tubes complying with Specifications S-17, S-32 Grades A and B, and S-40 under these alternate rules, are shown in Table P-16.

P-408. When the increase in maximum stress as set forth under Par. P-400(*b*) is used in the construction of shells and heads of boiler drums and of headers, the hydrostatic test pressure on such parts shall be at least 1.5 times the maximum allowable working pressure.

P-409. All the boilers constructed in accordance with these alternate rules and with other applicable Code rules shall be stamped with the Code symbol in accordance with Par. P-332, followed by the letter *A*, which also shall be shown on the manufacturer's data report.

REVIEWS OF BOOKS

And Notes on Books Received in the Engineering Societies Library

Ambassador to Industry

AMBASSADOR TO INDUSTRY: The Idea and Life of Herman Schneider. By Clyde W. Park, Bobbs-Merrill Company, New York, N. Y., 1943. Cloth, 6 × 8½ in., 324 pp., illus., $3.50.

REVIEWED BY H. P. HAMMOND[1]

HERMAN SCHNEIDER was one of the few men who, by pioneering in a new type of educational program, made an identifiable and important contribution to the "advancement of technical training."[2] The story of the conception of the Co-operative Plan which grew out of his own experiences as a student at Lehigh, of his early efforts to establish it, of his eventual success at Cincinnati in 1906, and of the later spread of the plan to more than a score of institutions is told with skill by his former colleague, Prof. Clyde W. Park, in his recent book "Ambassador to Industry." Professor Park tells more, however, than the mere story of the inception and growth of the Co-operative Plan in engineering, where it began. By describing the development at Cincinnati of the related divisions of engineering, commerce, applied arts, and scientific research, he indicates the breadth of Dean Schneider's conception of educational service and university organization as well as the qualities of initiative, resourcefulness, courage, and persistence which enabled him to carry his plan into actual execution.

It was characteristic of Dean Schneider that he was interested in the development of his concept of education rather than in the honors of position. While he accepted with reluctance and discharged with distinction for a time the duties of president of the University of Cincinnati following President Dabney's retirement, as soon as a successor satisfactory to the Board of Trustees could be found for this post Dean Schneider returned to "his home" in the dean's office, where he continued to promote the growth and improvement of co-operative education both within the university and elsewhere.

Sympathetic and generous understanding of students and faculty colleagues and skill in dealing with them was also one of Dean Schneider's notable characteristics. Throughout the entire story of Dean Schneider's life Professor Park contrives to portray the man's essential modesty and his aim to produce results valuable to others rather than for his own aggrandizement.

This book is one which educators, whether in engineering or other branches of education, as well as engineers in practice, will wish to read for the picture it paints of a fruitful life in a field of endeavor in which all the engineering fraternity are interested.

[1] Dean, School of Engineering, The Pennsylvania State College, State College, Pa. Mem. A.S.M.E.

[2] Quoted from the terms of bequest of the Lamme Medal which was awarded to Dean Schneider by the Society for the Promotion of Engineering Education in 1936.

Books Received in Library

THE A.B.C.'s OF MOTION ECONOMY. By A. R. Kosma. Institute of Motion Analysis and Human Relations, Newark, N. J., 1943. Cloth, 5½ × 8½ in., 133 pp., illus., diagrams, tables, $3.25. This small book outlines in simple and direct language the elements of motion, principles of motion economy, body members and their weights, and the pertinent principles of human relations. It is profusely illustrated by photographs and descriptive cartoon sketches. The material is arranged for ready reference.

A.S.T.M. SPECIFICATIONS FOR STEEL PIPING MATERIALS, prepared by Committee A-1 on Steel, October, 1943. American Society for Testing Materials, Philadelphia, Pa. Paper, 6 × 9 in., 255 pp., illus., diagrams, tables, $1.75 (to A.S.T.M. members, $1.25). Specifications cover pipe and tubes for conveying liquids, vapor, and gases at normal and elevated atmospheres, as well as those for the castings, bolts, nuts, and fittings used in piping installations. The specifications are the latest adopted by the Society.

A.S.T.M. STANDARDS ON PETROLEUM PRODUCTS AND LUBRICANTS, prepared by A.S.T.M. Committee D-2 on Petroleum Products and Lubricants; Methods of Testing, Specifications, Definitions, Charts, and Tables; American Society for Testing Materials, Philadelphia, Pa., September 1943. Paper, 6 × 9 in., 442 pp., illus., diagrams, charts, tables, $2.25. This pamphlet brings together in convenient form the 1943 report of the committee on petroleum products and lubricants, the various A.S.T.M. standard and tentative methods of test and specifications pertaining to petroleum.

The 1943 edition of this annual compilation includes 75 test methods, 14 specifications, and two lists of definitions of terms relating to petroleum and to materials for roads and pavements.

AERIAL PHOTOGRAPHS AND THEIR APPLICATIONS. By H. T. U. Smith. D. Appleton-Century Company, New York, N. Y., and London, England, 1943. Cloth, 6 × 9½ in., 372 pp., illus., diagrams, charts, tables, maps, $3.75. The major part of this book is devoted to the interpretation of aerial photographs and to map-making procedure, with particular regard to wartime requirements. The topographic and geologic aspects of interpretation receive special consideration, and practical, working procedures are emphasized. The viewpoint assumed is that of the user of aerial photographs, so the technique of taking them is not itself presented.

AEROPLANE PRODUCTION YEAR BOOK AND MANUAL (1), edited by G. W. Williamson, foreword by Sir C. Bruce-Gardner. Paul Elek (publishers) Ltd., Africa House, Kingsway, London, England, W.C. 2, May, 1943. Linen, 5½ × 8½ in., 564 pp., illus., diagrams, charts, tables, 40s 10d (41s 6d abroad). The purpose of this volume is to provide information in regard to production methods in a compact and accessible form. The use and treatment of aircraft materials are described, general and specialized manufacturing processes are explained, and the construction and characteristics of the varied types of airplane equipment are discussed. There is a large bibliography which includes numerous abstracts.

(The) AMERICAN PATENT SYSTEM, an Economic Interpretation. By W. B. Bennett. Louisiana State University Press, Baton Rouge, La., 1943. Cloth, 5½ × 9 in., 259 pp., diagrams, charts, tables, $3. Written from an economic viewpoint, this book describes our patent system and discusses its uses and abuses. Many questions involving the patentee, the corporate concern, and the public are answered explicitly, with reference to court decisions and the opinions of research workers and business men. The book is intended to be of use to students, inventors, corporations, and interested laymen.

CELLULOSE AND CELLULOSE DERIVATIVES. (HIGH POLYMERS, Vol. 5.) Edited by E. Ott. Interscience Publishers, New York, N. Y., 1943. Cloth, 6 × 9½ in., 1176 pp., illus., diagrams, charts, tables, $15. Thirty-six well-known workers have contributed to this monograph, which is intended to present "the most important modern scientific and technical information concerning cellulose and its derivatives and to have this information in such form that it becomes a thorough introduction for work on any cellulose problem by any person having reasonably wide general technical training." The book will be indispensable to all workers in the field.

DIESEL ENGINEERING HANDBOOK, 1943 de luxe edition, originally edited by L. H. Morrison, revised by C. F. Foell. Diesel Publications, New York, N. Y. Cloth, 6 × 9½ in., 966 pp., illus., diagrams, charts, tables, $7 in U.S.A.; $8 foreign. Practical, up-to-date information is provided upon the operation and maintenance of Diesel engines, valuable both to the owner and operator. The treatment is exhaustive, and the book is profusely illustrated from actual practice. Two chapters of

engineering fundamentals are devoted to brief descriptions of useful general engineering terms and equipment.

ELECTRO-PLATING, a Survey of Modern Practice, including the Analysis of Solutions. By S. Field and A. D. Weill. Fourth edition revised and enlarged. Sir Isaac Pitman & Sons, London, England; Pitman Publishing Corporation, New York, N. Y., 1943. Cloth, 5 × 7½ in., 437 pp., illus., diagrams, charts, tables, $5; 15s. The major part of this text is devoted to description of the practical processes by which metals are deposited on a surface. Fundamental principles are briefly discussed; the electroplating plant is described; mechanical and chemical cleaning of metals is covered; and chapters are included on the testing of electro deposits and on metal coloring.

ENCYCLOPEDIA OF SUBSTITUTES AND SYNTHETICS, edited by M. D. Schoengold. Philosophical Library, New York, N. Y., 1943. Cloth, 6 × 9½ in., 382 pp., tables, $10. This encyclopedia covers products that have been recently developed in order to replace critical materials that have become difficult or impossible to obtain. The properties and uses of these replacement materials are given, the materials needing to be conserved are listed with their practical substitutes, and a separate index of trade names is provided. All branches of industry, manufacture, and pharmaceutics are represented.

ENGINEERING ENCYCLOPEDIA, edited by F. D. Jones. Two volumes. Second edition. Industrial Press, New York; Machinery Publishing Co., Ltd., Brighton, England, 1943. Fabrikoid, 6 × 9½ in., 1431 pp., diagrams, charts, tables, $8, 2 volumes. This two-volume reference work supplies such practical and useful information as the various important mechanical laws, rules, and principles; physical properties and compositions of a large variety of materials used in engineering practice, and the characteristic features and functions of different types of machine tools and other equipment. The 4500 topics included are alphabetically arranged and cross-indexed for convenient reference and have been selected for their usefulness in the mechanical industries.

FUNDAMENTALS OF OPTICAL ENGINEERING. By D. H. Jacobs. McGraw-Hill Book Co., Inc., New York, N. Y., and London, England, 1943. Cloth, 5 × 8½ in., 487 pp., illus., diagrams, charts, tables, $5. By providing an introductory text which gives attention both to optical and mechanical design, this book fills a gap in the literature on optical instruments. The fundamentals of optics are first set forth, followed by descriptions of such representative instruments as telescopes, periscopes, gun sights, and rangefinders. Following this, the mechanical, electrical, and optical design of instruments is discussed.

Great Britain. Ministry of War Transport. INSTRUCTION BOOK FOR GOVERNMENT UTILITY GAS PRODUCER (Marks 6 and 8), fitted to Austin, Bedford, Commer, Ford, and Morris Commercial Vehicles. Great Britain, His Majesty's Stationery Office, London, England; British Information Services, New York, N. Y.; 1943. Paper, 7½ × 9¾ in., 32 pp., illus., diagrams, $0.45. This pamphlet describes the gas producer for motor vehicles which has been evolved by the British government and applied by five leading motor manufacturers. The construction of the producer and its application to various cars are described, and detailed instructions for operating it are given.

HEAT AND THERMODYNAMICS. By M. W. Zemansky. Second edition. McGraw-Hill Book Co., Inc., New York, N. Y., and London, England, 1943. Cloth, 6 × 9 in., 390 pp., illus., diagrams, charts, tables, cloth, $4. This intermediate textbook for students of physics, chemistry, and engineering discusses in the first half the fundamental ideas of heat, ideal gases, reversibility, entropy, etc. The remaining chapters deal with physical, chemical, and engineering applications in sufficient detail to show how the general principles are applied to specific cases.

THE HOUSE OF GOODYEAR, a Story of Rubber and of Modern Business. By H. Allen. Goodyear Aircraft Corporation, Akron, Ohio, 1943. Cloth, 6 × 9½ in., 417 pp., illus., tables, $2. This history traces the development of Goodyear Tire and Rubber Company from its organization in 1898 down to the present day. In addition to being the story of a great enterprise, it contributes largely to the history of rubber and to the development of modern business, the relations of capital and labor.

(An) INTRODUCTION TO HEAT ENGINES. By E. A. Allcut. University of Toronto Press, Toronto, Canada, 1943. Cloth, 6 × 9½ in., paged in sections, illus., diagrams, charts, tables, $2.75. This book provides a concise, interesting introduction to the field of heat engines in which the existence of the same general scientific principles in all types is indicated. Each chapter is illustrated by applications to steam engines, turbines, air compressors, and internal-combustion engines, their similarities as well as their differences being pointed out. Chapter four is an excellent brief historical survey.

MANUAL OF AIRCRAFT PRODUCTION, compiled and edited by B. H. de Selm. McGraw-Hill, Book Co., Inc., New York, N. Y., and London, England, 1943. Cloth, 5 × 8 in., 144 pp., illus., diagrams, charts, tables, $1.25. This little handbook, intended for the workman, is designed to give a basic understanding of how an airplane is produced. The arrangement follows the sequence of aircraft production. An admirable outline of the processes, the tools, and their use is provided.

MANUAL OF INSTRUCTIONS ON PROPER FIRING METHODS in the interest of Fuel Combustion and Conservation, Air Pollution, Smoke Elimination. Smoke Prevention Association of America, Chicago, Ill., 1943. Paper, 8 × 11 in., 58 pp., illus., diagrams, charts, tables, free upon application (send $0.25 for mailing cost). The following eight papers by various authors are contained in this manual: Preventing spontaneous combustion in stored coal; how to reduce smoke from hand-fired furnaces; the service engineer; underfeed stokers; practical application of statistical methods for controlling coal quality; overfire air performance applied to stationary plants; the modern spreader stoker; chain grate stokers.

DIE MATHEMATISCHEN HILFSMITTEL DES PHYSIKERS (Mathematical Tools for the Physicist). By E. Madelung, K. Boehle, and S. Flügge. Third edition, published and distributed in the public interest by authority of the Alien Property Custodian under license No. A-146 (American edition) Dover Publications, New York, N. Y., 1943. Cloth, 6 × 9½ in., 384 pp., diagrams, charts, tables, cloth, $3.50. The purpose of this book is to provide for physicists a concise statement of those parts of mathematics that are of direct use to them, and which could otherwise only be obtained by consulting a large variety of textbooks. The first section is devoted to mathematics; the second to physics. This American edition is a photographic copy of the German edition of 1935, offered at about one third the price.

MECHANICAL LOADING OF COAL UNDERGROUND. By I. A. Given. McGraw-Hill Book Co., Inc., New York, N. Y., and London, England, 1943. Cloth, 6 × 9½ in., 397 pp., illus., diagrams, charts, maps, tables, $4. Theory and practice are both covered in this manual. Many mining plans for all types of equipment and all seam conditions are given. The varieties of equipment are described. Face preparation, power supply, and the maintenance of equipment are also discussed.

METALLOGRAPHY OF ALUMINUM ALLOYS. By L. F. Mondolfo. John Wiley & Sons, New York, N. Y.; Chapman & Hall, London, England, 1943. Cloth 5½ × 9 in., 351 pp., illus., charts, tables, $4.50. Four main sections cover, respectively: the equilibrium diagram of aluminum alloys; the technique of macro- and micro-examination; the normal structure of the commercial alloys of aluminum; the effect of fabricating on the microstructure, with references to macrostructure and actual practices. Since the book is intended for the plant metallurgist rather than the student, no details are given on general metallurgy and metallography. There is a large, classified bibliography.

MODERN TIMBER DESIGN. By H. J. Hansen. John Wiley & Sons, Inc., New York, N. Y. Chapman and Hall, London, England, 1943. Cloth, 5½ × 8½ in., 232 pp., illus., diagrams, charts, tables, $3. The principles of timber design and timber mechanics are discussed, including formulas for use in design and design examples. Timber connectors and glued laminated construction are emphasized. There are chapters on preservatives, on plywood, and on the characteristics and properties of wood.

PATENT LAW for Chemists, Engineers, and Students. By C. H. Biesterfeld. John Wiley & Sons, New York, N. Y.; Chapman, and Hall, London, England, 1943. Cloth, 5½ × 8½ in., 225 pp., $2.75. The basic principles of our patent law are presented and illustrated by citation of and quotation from court decisions. The book is intended for persons without legal training who, in their daily work, are confronted at times with questions of patent law and practice.

PIPING STRESS CALCULATIONS SIMPLIFIED. By S. W. Spielvogel. McGraw-Hill Book Co., Inc., New York, N. Y., and London, England, 1943. Cloth, 8½ × 11½ in., 83 pp., diagrams, charts, tables, $2.50. This volume provides exact solutions to a large collection of typical problems in the calculation of pipe stress under changing conditions of temperature. The solutions are presented in arithmetical form, and the mathematical theory involved is discussed. The book is intended to assist the designer of piping layouts.

PLASTICS, PROBLEMS AND PROCESSES. By D. E. Mansperger and C. W. Pepper. Second edition, edited by W. H. Varnum. International Textbook Co., Scranton, Pa., 1942. Cloth, 9½ × 6 in., 350 pp., illus., diagrams, charts, tables, $3. This manual is intended for students of industrial art, home craftsmen, and others interested in working plastics on a

Library Services

ENGINEERING Societies Library books may be borrowed by mail by A.S.M.E. members for a small handling charge. The Library also prepares bibliographies, maintains search and photostat services, and can provide microfilm copies of any item in its collection. Address inquiries to Harrison W. Craver, Director, Engineering Societies Library, 29 West 39th St., New York 18, N. Y.

small scale. The materials available, tools needed, and methods of working are described, and designs and instructions given for many useful and ornamental articles. Lists of suppliers of materials and equipment are given. The information is practical and well presented.

PLYWOODS, Their Development, Manufacture, and Application. By A. D. Wood and T. G. Linn, with preface by L. Ottinger. Chemical Publishing Co., Brooklyn, N. Y., 1943. Cloth, $5\frac{1}{2} \times 9$ in., 373 pp., illus., diagrams, charts, tables, $4. This comprehensive work covers the entire process of manufacturing, from the tree to the various types of finished commercial plywoods. The physical properties of wood and plywood are discussed and a section is devoted to grading, testing, packing, and storing. Statistical and factual information is given about the plywood-producing countries. Applications are thoroughly dealt with. There is a glossary.

PRINCIPLES OF PHYSICAL METALLURGY. By F. L. Coonan. Harper & Brothers, New York, N. Y., and London, England, 1943. Cloth, 6×9 in., 238 pp., illus., diagrams, charts, tables, cloth, $3.25. The fundamentals necessary for a general appreciation of the properties of metals and alloys are presented in this brief elementary text, intended for students who require a knowledge of the nature and characteristics of the metals and alloys of commercial importance. The first section presents the physical principles. The succeeding two sections deal respectively with nonferrous alloys and alloys of iron and carbon.

RADIOGRAPHIC INSPECTION OF METALS. By O. Zmeskal. Harper & Brothers, New York, N. Y., and London, England, 1943. Cloth, $5 \times 7\frac{3}{4}$ in., 150 pp., illus., diagrams, charts, tables, $2.75. This introductory manual gives a clear, practical account of methods of radiographic inspection of metals. The equipment used, the fundamentals of radiographic practice, and the applications are discussed.

STRUCTURE of METALS, Crystallographic Methods, Principles and Data. By C. S. Barrett. McGraw-Hill Book Company, Inc., New York, N. Y., and London, England, 1943. Cloth, 6×9 in., 567 pp., illus., diagrams, charts, tables, $6. Crystallographic methods for investigating the structure of metals are discussed. The first four chapters explain the fundamentals of crystal lattices and projections and the general principles of the diffraction of X rays from crystals. Chapters 5 to 7 cover the technique of X-ray diffraction. The latter half of the book is devoted to the results of research along specific lines of current interest, including a chapter on electron diffraction. The book is intended for graduate courses.

SYMPOSIUM ON PAINT, Buffalo Spring Meeting, American Society for Testing Materials, March 3, 1943. American Society for Testing Materials, Philadelphia, Pa. Paper, 6×9 in., 60 pp., illus., diagrams, charts, tables, $1 (to A.S.T.M. members, $0.75). Contains seven papers presented at the Buffalo spring meeting of the society in 1943. These deal with developments in drying oils and fatty acids, with surface coating of opaque pigments and calcium carbonate extenders, with emulsion paints, paints for protective concealment, blackout paints, and luminescent paints.

SYMPOSIUM ON POWDER METALLURGY, Buffalo Spring Meeting, March 3, 1943, American Society for Testing Materials, Philadelphia 2, Pa., 1943. Paper, 6×9 in., 55 pp., illus., diagrams, charts, tables, $1 (to A.S.T.M. members, $0.75.) This pamphlet contains seven papers presented at the Buffalo Meeting of the society in March, 1943. Various current problems are discussed by authorities, and practical information is provided on recent developments.

TRADE UNION LIBRARY, 1943, prepared by H. C. Benjamin, Industrial Relations Section, Princeton University, Princeton, N. J., September, 1943. Paper, 6×9 in., 42 pp., $0.40. This book list presents a balanced working library of the best sources of knowledge and reported experience in the field of organized labor relations. The history of the labor movement, the structure of trade unions and their policies and programs, company personnel programs, and the relations of government and labor are covered. A list of publishers is included. The list will be useful to all students of labor relations.

(The) THERMODYNAMICS OF FIREARMS. By C. S. Robinson. McGraw-Hill Book Co., Inc., New York, N. Y., and London, England, 1943. Cloth, $6 \times 9\frac{1}{2}$ in., 175 pp., diagrams, charts, tables, $2.50. This book is intended to meet the demand of newcomers into the explosives and ammunition industry for information on interior ballistics. By means of thermodynamics, a sound theoretical basis is provided, and the basic problems are discussed. Although the book contains little, if anything, that is new, it brings together the available information for the first time. A good bibliography is given.

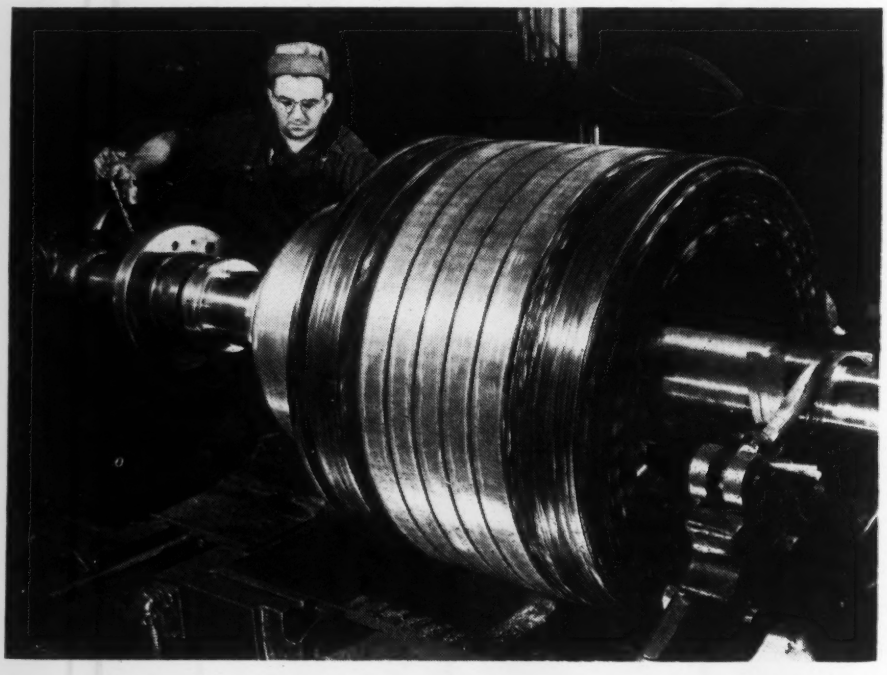
TUNGSTEN, Its History, Geology, Ore-Dressing, Metallurgy, Chemistry, Analysis, Applications and Economics. (American Chemical Society Monograph No. 94.) By K. C. L. and C. Y. Wang. Reinhold Publishing Corp., New York, N. Y., 1943. Cloth, $6 \times 9\frac{1}{2}$ in., 325 pp., illus., diagrams, charts, tables, maps, $7. This volume, by the leading authority on tungsten, covers its subject thoroughly. The geology of the ore deposits, ore dressing, metallurgy, and chemistry are discussed. A chapter is devoted to analysis. Further chapters consider the industrial uses of tungsten, substitutes for tungsten in steel alloys, and the economics of the tungsten industry. Chapters have useful bibliographies.

(The) USE OF PART-TIME WORKERS IN THE WAR EFFORT. By H. Baker and R. B. Friedman. Industrial Relations Section, Princeton, New Jersey, June, 1943. Paper, 7×10 in., 48 pp., tables, $1. This pamphlet summarizes the experience of American and British industries with part-time workers and is intended as a guide to those who are uncertain as to the desirability of undertaking such arrangements and those who have decided to do so. Methods of recruitment and training, hours of work, and wage rates are discussed and the advantages and problems of the method considered. There is a brief bibliography.

WATER POWER ENGINEERING. By H. K. Barrows. Third edition. McGraw-Hill Book Co., Inc., New York, N. Y., and London, England, 1943. Cloth, 6×9 in., 791 pp., illus., diagrams, charts, maps, tables, $6. The whole field of water-power development for hydroelectric purposes is covered in this standard textbook. Beginning with hydrology and the study of stream-flow data it continues through the construction and operation of dams, canals, and penstocks to a discussion of the power house and its equipment. There are chapters on turbine regulation and on transmission lines. The cost and value of water power are discussed, and typical installations are briefly described.

WELLS' MANUAL OF AIRCRAFT MATERIALS AND MANUFACTURING PROCESSES. By T. A. Wells. Harper & Brothers, New York, N. Y., and London, England, 1942. Cloth, $7\frac{1}{2} \times 10\frac{1}{2}$ in., 212 pp., illus., diagrams, tables, $3.50. The various materials and manufacturing processes used in airplane construction, and the characteristics, advantages, and disadvantages of each are clearly and concisely set forth in this book.

The WRIGHT BROTHERS. By F. C. Kelly. Harcourt, Brace and Company, New York, N. Y., 1943. Cloth, 6×9 in., 340 pp., illus., diagrams, $3.50. The story of the Wright brothers is presented for the nontechnical audience. The author describes the early life of the brothers, their years of experiment, their success and business life, and their dispute with the Smithsonian Institution. The book is authorized by Orville Wright, who read the manuscript.



POWER FOR THE NAVY

(Nearly ready for sea duty with the U. S. Navy is this spinning rotor being finished at East Pittsburgh, Pa., plant of Westinghouse Electric and Manufacturing Company. Each motor of this type has pulling power of 20 medium-priced passenger automobiles.)

A.S.M.E. NEWS

And Notes on Other Engineering Activities

Local Sections Delegates Discuss A.S.M.E. Affairs at National Conference for 1943

Purpose of Conference and Its Outstanding Topics

THE regular annual National Conference of Local Sections Group Delegates was held during the 1943 A.S.M.E. Annual Meeting, starting at 9:30 a.m. on Sunday, November 28. The business at hand was completed and the conference adjourned on Monday, November 29, at 12:15 p.m.

Similar conferences of delegates from local sections have been held for over 25 years. The present system of having delegates represent groups of local sections has been in vogue since 1932. Under this system two delegates and an alternate are selected by each of the eight regional groups into which the 70 local sections of the A.S.M.E. are divided. A few months before the Annual Meeting each group of local sections holds a Regional Conference at which the agenda for the Group Delegates Conference are discussed, and the delegates instructed as to the wishes of the majority of the local sections which they represent. During the Regional Conferences the members of the national nominating committee are also chosen and later formally approved by the Group Delegates Conference.

Chief Purpose of Conference

The chief purpose of the Group Delegates Conference is to provide a means whereby local sections can bring to the attention of the Council of the A.S.M.E. suggestions or criticisms of Society affairs with recommendations for action based on the opinion of the majority. The various items on the agenda are compiled from suggestions sent to the agenda secretary from various sources such as the local sections, Standing Committees, Professional Divisions, and the Council. The agenda items are submitted to the local sections for approval and comment before preparation of the final agenda for use by the Regional Conferences and the Group Delegates Conference. The 1943 agenda contained 35 items, which, as usual, embraced a wide variety of subjects.

The accompanying list gives the names of the delegates attending the Conference. Each delegate serves for two years, and each group is represented by one new delegate and one who has already served one year.

Three Outstanding Topics

Three of the topics discussed were outstanding as regards interest shown by the delegates, and general agreement as to the need for prompt and vigorous action.

DELEGATES

Group	*Term*	*Name*	*Section*
I	1 year	F. C. Richardson, New Haven, Conn.	New Haven
	2 years	R. M. Scott, Providence, R. I.	Providence
II	1 year	W. S. Gleeson, Brooklyn, N. Y.	Metropolitan
	2 years	H. C. R. Carlson, Brooklyn, N. Y.	Metropolitan
III	1 year	F. S. Erdman, Ithaca, N. Y.	Ithaca
	2 years	F. W. Miller, Philadelphia, Pa.	Philadelphia
IV	1 year	W. R. Chambers, Knoxville, Tenn.	East Tennessee
	2 years	F. J. Reed, Durham, N. C.	Raleigh
V	1 year	R. R. Slaymaker, Cleveland, Ohio	Cleveland
	2 years	J. G. Martin, Cincinnati, Ohio	Cincinnati
VI	1 year	C. C. Austin, Chicago, Ill.	Chicago
	2 years	W. W. Babcock, Peoria, Ill.	Central Illinois
VII	1 year	J. G. McGivern, Spokane, Wash.	Inland Empire
	2 years	B. T. McMinn, Seattle, Wash.	Western Washington
VIII	1 year	L. J. Cucullu, New Orleans, La.	New Orleans
	2 years	G. H. Woelbing, Denver, Colo.	Colorado

These were:

1 The problem of increasing A.S.M.E. membership among engineers in the aviation industry, and of organizing Society affairs so as to best serve the interests of such men.

2 The problem of organizing all members of the engineering profession into a central cohesive body for the purpose of better serving the nation and the public, and to increase the prestige and importance of the engineer in the opinion of the general public.

3 The so-called Kilgore Bill, also known as Senate Bill S. 702, which would provide for the setting up of a national office of Scientific and Technical Mobilization, to control and regulate the activities of all scientific and technical personnel, and the research organizations with which they are connected.

Opposition to the Kilgore Bill was most vehement. The delegates acted unanimously in passing several resolutions recommending that the Society take every possible action to register opposition to the Bill at the Senate hearings, and that local sections and their individual members be requested to write their own Senators and Congressmen expressing their disapproval.

President-Elect Gates Addresses Delegates

The problems which we shall have to face in the transition from war to peace were also discussed at some length. President-elect R. M. Gates addressed the delegates on this subject. He pointed out that this transition will be more difficult in many ways than the change from peace to war, because the patriotic motives which spurred on the transition from peace to war will not be present. He said that the Society and its individual members should take an active interest in solving these problems.

President Coes Talks on Co-Ordination

President Coes addressed the delegates on co-ordination of the various elements within the engineering profession. He pointed out the desirability of such a central body in raising the prestige of the engineering profession to that of the medical, legal, and architectural professions. Mr. Coes expressed the opinion that the central body probably would have to include other branches not represented by the four Founder Societies. He asked that suggestions be sent to Dean Robert L. Sackett, Secretary of the Joint Conference Committee of Presidents and Secretaries of the Founder Societies, which is studying the problem.

Professor John E. Younger explained to the delegates the work which has already been done under his direction to encourage membership in the A.S.M.E. by engineers in the aviation industry and to serve adequately the needs of such men who have already joined. He also advised the delegates as to how this program could best be expanded and improved in the future. Dr. Younger has done an excellent job and has earned the admiration and gratitude of all Society members.

Among the others who visited the Conference as advisers or observers were the following: S. R. Beitler, C. E. Davies, Ernest Hart-

LOCAL SECTIONS DELEGATES

(*Front row, left to right:* F. C. Richardson, W. S. Gleeson, F. S. Erdman, W. R. Chambers, R. R. Slaymaker, C. C. Austin, J. G. McGivern, L. J. Cucullu. *Back row, left to right:* R. M. Scott, H. C. R. Carlson, F. W. Miller, F. J. Reed, G. H. Woelbing, B. T. McMinn, J. G. Martin, and W. W. Babcock.)

ford, J. A. Keeth, O. B. Lyman, T. S. McEwan, S. D. Moxley, A. R. Mumford, Clair B. Peck, and F. L. Wilkinson, Jr.

Officers for 1944 Conference

The last item of business was the election of the officers for the 1944 National Conference:

Speaker	H. C. R. Carlson	Metropolitan
Vice-speaker	B. T. McMinn	Western Washington
Secretary	R. M. Scott	Providence
Agenda Chairman	W. W. Babcock	Central Illinois

The report of the findings and recommendations of the 1943 Conference was presented to Council on Friday morning, December 3, by Speaker C. C. Austin. The report included a complete set of minutes giving the action on all items of the agenda, together with a letter which stressed the more important points discussed.

Officers handling this year's Conference were C. C. Austin, *speaker;* F. C. Richardson, *secretary;* and L. J. Cucullu, *agenda secretary.*

W. S. GLEESON.[1]

[1] Member A.S.M.E.

A.S.M.E. Calendar

of Coming Meetings

April 3–5, 1944
A.S.M.E. Spring Meeting
Birmingham, Ala.

May 8–10, 1944
A.S.M.E. Oil and Gas Power Division Meeting
Tulsa, Okla.

June 19–22, 1944
A.S.M.E. Semi-Annual Meeting
Pittsburgh, Pa.

(*For coming meetings of other organizations see page 32 of the advertising section of this issue.*)

Women's Auxiliary to the A.S.M.E. Holds Twentieth Annual Meeting

Mrs. Rudolph F. Gagg, President for 1944

THE twentieth annual meeting of the Woman's Auxiliary to The American Society of Mechanical Engineers was held at the Hotel Pennsylvania from November 29 to December 3, 1943. The general chairman, Mrs. J. Noble Landis, and the vice-chairman, Mrs. G. E. Hagemann, with the assistance of Mrs. F. M. Gibson, chairman for Registration, Mrs. Earl B. Smith, for Publicity and Printing, Mrs. R. B. Purdy for the Annual Luncheon, Mrs. H. R. Kessler for Excursions, Mrs. F. M. Farmer and Mrs. C. M. Sames for the Monday Tea, Mrs. F. M. Gibson, Jr., for "AsKme," Mrs. Robert M. Gates for flowers, and the many women on their committees, planned and executed an enjoyable program.

Swedish Luncheon and Informal Tea

The Board of Governors of the Engineering Woman's Club, 2 Fifth Avenue, New York, N. Y., extended the courtesies of the Club to all women attending the A.S.M.E. Annual Meeting, and the initial event was held there. It was a Swedish luncheon planned by Mrs. Piero di Prossedi, who gave a talk on her native land with a large display of articles.

Later in the afternoon, the second annual Informal Tea was given at the Hotel Pennsylvania and afforded a large number of both men and women the opportunity to renew old acquaintances and make new ones. Many attended broadcasts at Radio City in the evening.

Annual Business Meeting and Luncheon

Tuesday morning at 10:30 the annual business meeting convened at the Hotel, with Mrs. E. C. M. Stahl presiding.

It was with a feeling of deep sorrow that the Auxiliary learned of the death of Miss Burtie Haar. Miss Haar was one of those who organized the present Auxiliary, which is an outgrowth of the Ladies' Committee. Her loyalty and conscientious work during these many years made her a vital part of the Auxiliary. Miss Haar served on the Board of the Metropolitan Section and on the National Board. She will be missed greatly.

The treasurer, Mrs. Albert Morgan, reported a balance in General Fund of $73.43, Student Loan Fund $4397.32; Calvin W. Rice Scholarship Fund $723.63; and this year's Calvin W. Rice Scholarship award $900.

Mr. Coes, president of the A.S.M.E., and Mr. Gates, president-elect, were presented. Both expressed appreciation of the splendid work of the Auxiliary, and a desire that measures be taken whereby the entire membership of the A.S.M.E. might become familiar with the aid extended to junior and senior engineering students, and the scholarship given to a South American postgraduate student each year.

Reports were read by the chairmen or sponsors from all the sections. All have made progress financially and socially.

The following officers were elected for 1944: President, Mrs. Rudolph F. Gagg; first vice-president, Mrs. C. P. Bliss; second vice-president, Mrs. G. W. Farney; third vice-president, Mrs. R. M. Gates; fourth vice-president, Mrs. Justin J. McCarthy; fifth vice-president, Mrs. Sydney F. Duncan; recording secretary, Mrs. Matthew S. Cumner; corresponding secretary, Mrs. Crosby Field; treasurer, Mrs. Charles E. Gus.

The meeting adjourned for the Annual Luncheon, held at the Engineering Woman's Club, which was a gala occasion for members and guests. The speaker was Dean Dexter S.

Kimball of Cornell University. His theme was "Freedom and Responsibility," and he pointed out that not the "Four Freedoms" but economic freedom and freedom of enterprise had made our nation great, and they must continue, unless our form of government be greatly changed and these be completely destroyed.

Chinatown

Wednesday was spent in Chinatown, in its shops and museum, and a mission that was once a famous opium den. Lunch was served at the "Port Arthur." This was the most popular event, and greatly enjoyed by all.

In the evening the ladies attended the annual dinner with the men and enjoyed thoroughly honors night, the reception, and dance.

"Lighthouse for the Blind" and Frick Collection

The Thursday tour was to the Lighthouse for the Blind, a center for vocational training and help for the blind. An organ recital was given by the students. The afternoon was spent in the Frick Art Gallery, where a recital of national and folk music was rendered at 3 o'clock, a fitting finale for the Annual Meeting of 1943.

MRS. EARL B. SMITH,
Chairman, Publicity and Printing

A.S.M.E. and E.I.C. Sign Co-Operative Agreement

AT the conclusion of the 1943 Annual Meeting of The American Society of Mechanical Engineers, Robert M. Gates, president A.S.M.E., and Kenneth M. Cameron, president of The Engineering Institute of Canada, jointly announced that an agreement has been signed between the two organizations whereby co-operative endeavors may further promote the war effort and advance the mutual interests of the societies, for the benefit of the engineering profession.

Such co-operation includes a program of joint meetings, a close collaboration of technical committees on special subjects, and a consideration of joint research projects which may be developed to be of mutual value to engineers of both countries.

Austin Wright, general secretary of the E.I.C., who attended the 1943 A.S.M.E. Annual Meeting, said that by this agreement it may be possible for the Institute to extend to Canadian engineers and engineering students the specialized services of the A.S.M.E.

A joint Conference Committee, consisting of three members from each society, has been formed to work on future plans. They are: James W. Parker of The Detroit Edison Company, former president of the A.S.M.E.; A. G. Christie, professor of mechanical engineering, The Johns Hopkins University, Baltimore, Md., former president of the A.S.M.E.; Albert E. White, director of engineering research, University of Michigan, Ann Arbor, Mich., John B. Challies, vice-president and assistant general manager of the Shawinigan Water and Power Company, Montreal, Quebec, Canada; John Hall of Combustion Engineering Company, Ltd., Toronto, Ontario, Canada, and John E. Armstrong, chief engineer, Canadian-Pacific Railway Company, Montreal, Quebec, Canada.

A report which preceded the signing of the agreement pointed to the "cordial relationships for over 30 years between the two societies," and said that the establishment of a plan for working together "may have far-reaching influence in enhancing the effectiveness of the professions in both nations.

"During the war, intimate co-operation has prevailed in research between engineers and scientists in Canada and the United States. The technical advances brought about by the war and the possibilities of engineering development after the war provide a fertile field for active co-operation between the two societies."

The E.I.C. is the only all-embracing, purely engineering national society in Canada. It has about 200 members in the United States.

The A.S.M.E. has about 285 members in Canada. It has a local section styled the Ontario Section, with headquarters at Toronto, and student branches at the University of Toronto, Queens University, and the University of British Columbia.

The first joint meeting ever held in the history of the two bodies took place in Toronto, September 30 through October 2 of this year.

Two American Standards Announced

THE American Standards Association has announced the approval of a new standard, Safety Code for Jacks (B30.1–1943). The code applies to the construction and use of all portable, manually operated jacks, except those which are supplied with automobiles as part of their standard tool equipment; it covers lever and ratchet, screw, and hydraulic jacks. The purpose is to provide reasonable safety for both the person operating the jack and the property involved, and to act as a guide to manufacturers, users, and insurance carriers. The code can be adopted by regulatory authorities if and when they deem it expedient to do so. The requirements given are the minima compatible with reasonable safety and are by no means to be considered design specifications. They are merely precautionary measures.

For the convenience of users, a new American Standard has just been approved which brings together in one document the various standards covering pipe plugs, pipe bushings, pipe caps, and locknuts used in piping systems and other piping applications. The new combined standard is known as American Standard for Ferrous Plugs, Bushings, Locknuts, and Caps with Pipe Threads (B16.14-1943).

Both standards may be obtained from the American Standards Association, 29 West 39th St., New York, 18, N. Y.

Code for Pressure Piping, Two New Subcommittees

AS a result of the recommendations of the Subcommittee on Scope and Intent of the Sectional Committee on Code for Pressure Piping, B31, two new special subcommittees are being appointed to function under the procedure of Sectional Committee B31. One of these subcommittees will formulate requirements for instrument piping, the other will develop quality factors for castings and working stresses for steel castings, forgings, plate, and bars, all for inclusion in the American Standard Code for Pressure Piping, A.S.A. B31.1–1942.

It has been recognized for some time that present code requirements and standards for instrument piping are not sufficiently complete to provide adequate assurance of the safety of such piping systems. The new subcommittee to handle this assignment will consist of members of Sectional Committee B31 selected from the subcommittees that developed each section of the code representing the several types of piping, together with representatives of interested manufacturers.

The second subcommittee is being formed in accordance with a recommendation made by the recently appointed Joint Conference Committee on Piping Codes and Standards, and endorsed by the Subcommittee on Scope and Intent. This subcommittee's assignment will consist of two parts: (1) The formulation of working stresses for steel castings, forgings, plate, and bars for use in designing special fittings, which are not intended for application, however, to existing standard designs; (2) the development of rules for casting quality factors which will be applicable only to design of special castings.

Both of these subcommittees will be asked to develop their recommendations in the form of rules and tables similar to like data contained in the A.S.M.E. Boiler Construction Code.

S. A. Moss to Be Honored by I.A.S.

THE Sylvanus Albert Reed Award for 1943, conferred annually by the Institute of the Aeronautical Sciences in recognition of a notable contribution to aeronautical engineering, will be presented to Sanford A. Moss, fellow A.S.M.E., General Electric engineer, "for development of the turbosupercharger which has made possible the high altitude operation of aircraft." The award will be presented at the Honors Night Dinner of the Institute which will take place in New York on Jan. 24, 1944.

The Award was endowed in 1933 through a bequest of $10,000 by the late Dr. S. A. Reed and is given annually for outstanding achievements in the aeronautical sciences. It was awarded in 1942 to Igor I. Sikorsky of the Sikorsky Aircraft Division of the United Aircraft Corporation.

C. E. Lucke Honored by Fellow Alumni

ONE of the four Townsend Harris Medals of the Associate Alumni of the College of the City of New York was presented on Nov. 13, 1943, to Charles Edward Lucke, Fellow A.S.M.E. The citation read:

Charles Edward Lucke, '95: Long professor of mechanical engineering in Columbia University and now professor emeritus, you have been an inspiration to many academic generations. While you were training young men destined to eminence in the field you made substantial contributions to the scholarship of your subject and rendered valued service as a consulting engineer. In time of war you made your skill and knowledge available first to the Navy and later to the makers of airplanes.

President's Page

ON behalf of the new members of the Council, I wish to express our appreciation of the opportunity you are giving us to render greater service to the Society. It is a great honor and a great privilege.

This is a momentous period for our profession and for our Society.

We have had to meet the challenge of war—a mechanized war in which the past achievements and the current abilities of engineers are being put to a grueling test. With no false pride we can say that American engineering has stood that test splendidly. Its products are on every fighting front of the United Nations. They exemplify the American genius, not only for constant improvement of the means of production, but also for timely adaptation of product to changing needs. They are giving that superiority in equipment without which the strategy of our military leaders and the bravery of our fighting men would be in vain. Engineers in uniform or mufti or overalls, in arctic cold or tropic heat, at battle fronts and on supply lines, in factories and laboratories, have done and are doing their part toward the victory we begin to see on the horizon.

This Society has been forehanded in initiating plans for the conversion of our activities from peace to war. This work must be continued. We must not let up in these efforts until victory is definitely won. Lest peace finds us unprepared, we must also begin now to meet the tremendous postwar challenge—just as engineers in many of our industries have been engaged already in plans for the future. Right here at home, though no bombs have wrecked our cities and factories and railways and homes, we shall have an extraordinary job of rehabilitation. Ten years of economic depression and then several more years of war will have created an accumulation of needs that it will tax our ingenuity and enterprise to meet. And abroad, in war-torn lands reduced to industrial helplessness and among peoples eager to secure the benefits of modern technology, the service of American engineers will be in unprecedented demand.

Social as well as technological problems confront us. In a technological civilization engineering deals more and more with social problems. Indeed, it creates them and must help to solve them.

Even before we pass the peak of our war effort, such postwar problems begin to crowd in upon our thinking—problems that vitally involve the future of the nation and the future of our profession.

Your Council will, I am sure, do its best, within its range, to carry on earnestly the war activities of the Society and to develop the postwar plans already started. As we take up the trust you have committed to us, we realize that the only durable honor for us is what we may earn by performance. In our efforts to aid the Society to meet the twofold challenge to war conditions and postwar problems, we crave the counsel and co-operation of all our divisions, all our sections, all our committees, all our members.

For my own part, I assure you of my earnest desire as your president to give you the best service of which I am capable and to devote constant effort to advancing the interest of the Society and the engineering profession.

(*Signed*) R. M. GATES, *President, A.S.M.E.*

Among the Local Sections

Bridgeport Section Hears T. H. Beard Discuss Postwar Planning

Industry and State Government in Connecticut Collaborate in Studying Employment Problem

STATING that he preferred to consider postwar planning as a preventative for postwar problems, Theodore H. Beard, vice-president of the Dictaphone Corporation, and past chairman of the Bridgeport Section, addressed a meeting of that section, held at the Public Library, Bridgeport, Conn., on November 16, 1943.

Mr. Beard speaks with authority on this subject as State Chairman of the Committee for Economic Development. He is also a member of the State Postwar Planning Board and of the Connecticut Development Commission.

In discussing the concerted approach to postwar planning being made, Mr. Beard stated that for some time New England had been "sold" on the idea, and much groundwork had been done for the future by "The New England Council."

Connecticut Development Commission

The Connecticut Development Commission has been instrumental in bringing to life little known or forgotten resources of the state. Connecticut is now furnishing mica in fair quantities, which before the war came largely from India or Africa. This industry will continue after the war, the speaker said.

Beryl has been found in Connecticut. This is used in the hardening of copper. Glass is now being made from Connecticut's silica. In East Canaan, there is a large magnesium factory. The deposits of magnesium start at Georgetown and run clear to the Canadian border. In the Revolutionary days, iron from Connecticut was used for making cannon for George Washington. At the present time surveys are being made between Lakeville and Sharon to determine whether the deposits are sufficient to make mining worth while.

After the war, the durable-goods market is going to be large, with practically all industry needing replacements of machines. The real problem is that of the returning serviceman and this problem is up to industry to a very large extent, the speaker said.

Postwar Production Must Be Increased by 30 to 40 Per Cent

Today, in industry, long hours are being worked. The average comes nearly to 57 hours a week. Reduction in the working hours to normal will furnish considerable employment to servicemen. There are many women, high-school boys, and older persons, who are in industry today because of the war and will stop working as soon as peace returns. In spite of a considerably lower production after the war, more persons can be employed, but to furnish employment for all it will be necessary to increase the production of our plants 30 to 40 per cent over what it was in 1940, Mr. Beard said. Big factories and small stores and farms must all consider their own problems and how they can increase their production, the speaker declared.

Baltimore Section Hears About Post Engineer

The Baltimore Section held a meeting on October 18, at which a large delegation from Aberdeen contributed to a fine attendance.

The speaker of the evening, Lieut. Col. L. C. McCabe, Chief, Utilities section, Repairs and Utilities Branch Office, Chief of Engineers, Washington, D. C., addressed the meeting on the subject, "Utility Activities at Army Installations." After an interesting description of the magnitude and ramifications connected with the installation of utilities at the hundreds of Army camps, he ended with a semihumorous definition of that overworked individual responsible for this maintenance, the "post engineer:"

He must be a sales-promotion expert, a good credit manager, correspondent, attend all staff conferences, clinics, labor-union meetings, tournaments, funerals, and births, visit brother officers at hospitals as well as jails. He must contact all other branches on the post every week; and in his spare time, look out for the interest of the area engineer, district engineer, division engineer, and the chief of engineers. He must have a wide range of telephone numbers when entertaining visiting executives and inspecting officers. He must also be an expert driver, a good talker, dancer, traveler, bridge player, poker player, golf player, diplomat, financier, philanthropist, and an authority on palmistry, chemistry, archeology, psychology, physiology, meteorology, criminology, dogs, cats, horses, and trailers.

He must be a man of vision and ambition; a before-and-after-dinner speaker; a night owl, working all day, driving all night, appearing fresh the next day. He must learn to sleep on the floor, eat two meals a day to economize on traveling expenses. He must be able to entertain the Commanding Officer's wife. He must be able to inhale dust, to live outside at 10 below, and work all summer while looking cool and comfortable.

He must be a man's man, a ladies' man, a model husband, a fatherly father, a devoted son-in-law, a good provider, a plutocrat, Democrat, Republican, a New Dealer; a technician, electrician, machinist, mechanic, ambidextrous, and, above all, a specialist on priorities.

War-Production Conference Held at Kingsport

On November 12, at the Kingsport Civic Auditorium in Kingsport, Tenn., the first War Production Conference of the 1943–1944 season swung into action with six panel sessions. An informal dinner was held at 6:30 p.m. The toastmaster was David R. Shearer, member A.S.M.E., division manager of the East Tennessee Light and Power Company. Speakers during the dinner were John A. Hunter, War Production Board representative, and Paul T. Norton, Jr., consultant in the Office of Production Research and Development and professor of industrial engineering at the Virginia Polytechnic Institute, member A.S.M.E.

At 8:00 p.m. panel discussions were held as follows:

1 Mechanical Maintenance; Chairman, L. H. Haller, member A.S.M.E., chemical engineer of the Tennessee Eastern Corporation.

2 Electrical Maintenance; Chairman, C. J. Bryan, Kingsport Utilities, Inc.

3 Welding and Forming Metals; Chairman, W. F. Hamlin, Bristol Aerometals Corporation.

4 Production Control; Chairman, E. J. Triebe, Kingsport Press, Incorporated.

5 Manpower Problems; Chairman, A. S. Zoerb, Tennessee Eastman Corporation.

6 Machine Tool Operation; Chairman, C. C. Wilson, Enterprise Wheel & Car Corporation.

Baltimore Hears Dr. Witt on Plastics and Metals

On November 15, an audience of 200 persons heard Dr. Ralph A. Witt speak on the subject, "Plastics and Metals," at the Baltimore Section meeting. The practicability of plastics versus metals was discussed. Plastics will not do all that metals will and vice versa, yet the combination should and would be complementary. Examples and imitations of plastics were discussed. Dr. Witt emphasized that plastics are not a cure-all, yet there is a tremendous need for them.

Dr. Lichtenstein at Boston Section

After a dinner at the University Club of Boston at which 32 were present, 75 heard Dr. Joseph Lichtenstein of the Foster Wheeler Corporation, member A.S.M.E., speak on "Cooling Towers." Dr. Lichtenstein gave a short historic outline of the development of various types of cooling towers. He discussed the theory of performance and dwelt at greater length on the variations of performance under weather conditions and the principles that should govern the specification and selection of towers. The talk was aided by slides of actual towers. Mr. Warner of General Electric Company plastics division gave a short talk on plastics for construction purposes.

Buffalo Section Host to S.A.E. and A.S.M.

On October 19, the Buffalo Section met to hear E. F. Boro, of the Durez Plastics Company, speak on "Recent Developments in Plastics and

Plastics Molding." This Section met again on November 16, at the Markeen Hotel, Buffalo, at which time Paul Dubosclard, member A.S.M.E. and president of the Farnham Manufacturing Company, Buffalo, N. Y., spoke on "High-Speed Milling." There was an attendance of 125 persons at this meeting. Michael Field, member A.S.M.E., of the Cincinnati Milling & Machine Company, discussed high-speed milling of steel. This was a joint meeting of the A.S.M.E., S.A.E., and A.S.M. Sections with the A.S.M.E. acting as host.

Central Indiana Hears Harold V. Coes

The Central Indiana Section held its meeting on November 10, at the Indianapolis Athletic Club with an attendance of 52 persons. Harold V. Coes, president of the A.S.M.E., spoke on "Scheduling Machines for Maintenance and Maximum Use." President Coes' talk was followed by a discussion of general postwar plant conversion and planning led by Dean A. A. Potter of Purdue University and Wm. A. Hanley of the Eli Lilly Company, both past-presidents of the Society.

Chicago Section Hears More About Patent System

On November 22, the Chicago Section held a meeting with an attendance of 66 members and guests who heard Dr. A. A. Potter, dean of the school of engineering of Purdue University, past-president A.S.M.E., speak on, "The Engineer and the American Patent System." This paper appears elsewhere in this issue of MECHANICAL ENGINEERING, so that the talk represented something of a preview of the paper. Questions at the close of the presentation brought out many helpful ideas for the use of the National Patent Planning Commission. This Section reports that Dr. Potter was never in better form.

Cleveland Section Has Four Speakers

On November 11, the Cleveland Section met with an attendance of 100 to hear A. T. Colwell, vice-president of Thompson Products, Inc., speak on probable engineering trends in the field of automotive engineering after the war. D. S. Cole, assistant general manager of the National Machine Tool Builders Association, then discussed possible changes in machine tools. Major John Berry, commissioner of the Cleveland airport, spoke on the future of transportation. Alfred Iddles, application engineer of The Babcock & Wilcox Company gave his opinions on the future design of generating stations. The Section reports an excellent presentation on the part of all four speakers on the expected status of their industries and their products, respectively, after the war.

Dr. Olpin Talks on "Bushido" at Columbus Sections

The Columbus Sections of the A.S.M.E. and A.I.E.E. met on November 3 at the Battelle Memorial Institute. About 85 persons were present to hear the speaker of the evening, Dr. A. R. Olpin, director of industrial research of the Ohio State University, who spoke on "Bushido—The Way of the Japanese Warrior." Dr. Olpin spent about four years in Japan and was engaged in an effort that brought him in daily contact with the Japanese people in their homes. He learned the language, observed the behavior of the people, and studied their code of ethics. His talk dealt with the background of the Japanese people as it affects the war.

Fort Wayne Section Hears Dr. T. H. Troller

On November 17, the Fort Wayne Section held its meeting at the Y.M.C.A. in Fort Wayne, Indiana, to hear Dr. Theodor Henry Troller of the La Del Manufacturing Company, member A.S.M.E., speak on "Development of Axial-Flow Fans." Dr. Troller discussed the performance of a typical axial-flow-fan installation. He believes this fan will have many uses after the war, especially in domestic heating and ventilating, and he also thinks it could be adapted for use as an induced-draft fan.

Subject at Hartford Section Is "Big Inch Oil Pipe Line"

On November 16, the Hartford Section met at the Hotel Bond with an attendance of 105, to hear A. B. Frost speak on "The Big Inch Oil Pipe Line." Mr. Frost presented H. P. Binder's paper, the subject originally picked from the speaker's list. This was a well-prepared and interesting paper, especially to Easterners.

Water-Treatment Problems at Kansas City

The Kansas City Section met on November 19, at the University Club, Kansas City, Kansas. Tom Messplay gave a history of the development of water-treating processes, with special attention to problems encountered in present-day practice, particularly the processing of waters for high-pressure equipment.

Production Controls at Louisville Section

The Louisville Section met at the Speed Scientific School, Louisville, Ky., on November 18, at which time K. O. Morrison of McDonald Brothers, Boston, Mass., spoke on "Establishment and Use of Production Controls." Mr. Morrison discussed methods of taking time studies, their analysis, and the importance of these data in controlling scheduling to routing production. An Iowa State College sound film "Motion Studies" was shown.

The "Big Inch" Explained to Milwaukee Section

On November 10, the Milwaukee Section listened to H. P. Binder, manager of the centrifugal-pump department of Allis-Chalmers Manufacturing Company, speak on "The 24-Inch Pipe Line (Big Inch) From Texas to the Atlantic." He described the materials used and the methods employed in accomplishing this engineering feat. In October, 1943, the average delivery through the whole line was 310,000 bbl and some peak rates were as high as 325,000 bbl per day.

Plainfield Section Hears Allen H. Pendlebury

On November 17, the Plainfield Section met at the Elks Club, Elizabeth, N. J., to hear Allen H. Pendlebury speak on "Manufacture of Large-Diameter Pressure Vessels." A film was shown on the manufacture of pressure vessels from receipt of raw materials to shipment of finished product. Mr. Pendlebury then high-lighted the problems encountered.

Rockford Section Tours Plant of Sundstrand

A joint group representing the Rockford Engineering Society and the Rockford A.S.M.E. Section met on November 15, at the Sundstrand Machine Tool Company to hear company engineers discuss the "Sundstrand Hydraulic Turret." The program consisted of a tour through the Sundstrand plant, and a demonstration of a working model of a self-contained hydraulically operated gun turret.

History of Fluid Meters at San Francisco

On November 18, the San Francisco Section met to hear D. H. Fuller, industrial engineer of the Foxboro Company, speak on "History of Fluid Meters." Mr. Fuller gave an account of the development of fluid metering. This chronological account showed the earliest developments and their application. He briefly mentioned the modern metering methods and indicated the trend that future developments may follow.

Dr. H. W. Leverins Speaks at Susquehanna Section

The Susquehanna Section met on November 1, to hear Dr. H. W. Leverins speak on "Luminescent and Fluorescent Materials." Dr. Leverins, who is with the Princeton Research Laboratory of R.C.A., is one of the foremost chemists in the field and has developed numerous processes in the manufacture of radio tubes and cathode-ray tubes using luminescent and fluorescent materials. He has appeared on the nation's radio network on the "What's New" program. Over 70 men and women attended this splendid talk held in the meeting hall of Armstrong Cork Company, Lancaster, Pa.

An Aeronautics Meeting in Texas

An aeronautics meeting was held on November 19, in the Sam Houston Room of the Rice Hotel in Houston, Texas, by the Texas Section. Dr. H. W. Barlow, professor and head of the aeronautical-engineering department at Texas A.&M. college, spoke on "The Present and Future Airplane of America." He used lantern slides to depict the more modern airplanes of the present and pointed out which

would likely have the chief influence in the design of the postwar period. David R. Taylor, local manager of Pan American Airways, then spoke on "Air Transportation, Domestic and International," and discussed the future of air transportation, talking mainly on feeder lines and international transportation. He explained the troubles to be expected in a large number of American companies competing with a single government-subsidized company in each foreign nation. The Student Branch of Rice Institute attended this meeting. Because the majority of the student members were Navy V-12 members, the Section thought it desirable to invite them to some of the senior meetings as most of these men will go directly into service upon leaving school, and it may be quite a while before many of them will have the opportunity of attending a regular meeting. Two colored sound films were shown. One showed the building of North American airplanes in Dallas, and the other depicted the operation of the *Mustang* attack plane in flight.

Stratosphere Flying at Virginia Section

On October 29, the Virginia Section met at Ewart's Cafeteria in Richmond, Va., and heard Dr. John E. Younger, head of the mechanical-engineering department, University of Maryland, member A.S.M.E., talk on "Stratosphere Flying With Pressure Cabins." Dr. Younger explained the history back of the development of the pressure cabin today and presented personally Col. Greeve, the person responsible for much of the work in collaboration with Dr. Younger. The meeting was interesting and instructive with an attendance of 90 persons.

Western Massachusetts Section Hears Prof. J. E. Younger

The regular monthly dinner meeting of the Western Massachusetts section was held on November 16, with 52 members and guests present. Maynard Saunders, in charge of arrangements for the evening, introduced Prof. John E. Younger, executive secretary of the aviation division of A.S.M.E., and professor and chairman of mechanical and aeronautical engineering at the University of Maryland, whose subject was "Building Airplanes, Past, Present, and Future."

Professor Younger, who used lantern slides to illustrate his talk, began with a comparison of the "Jenny," used in the last world war and the present B-19, which represented 25 years of airplane development, illustrating the former and now obsolete wire, wood, and fabric construction, compared to the present use of monocoque and beam construction which came into its own in 1930, when the Martin B-10 bomber was produced.

Looking to the future, the speaker could see great changes and a bright future, comparable to our present methods and cost of travel. Some of the problems that must be overcome are the ability to weld aluminum alloys, and the further elimination of waste and unnecessary metal in the present planes, thus decreasing weight, a major problem. Different methods of propulsion, including jet motors and gas turbines are already under study. Almost anything can be expected in the aircraft field with time the only questionable element.

With the Student Branches

Student Engineers Challenged to Meet Problems of War and Peace

Annual Meeting Student Luncheon Attended by Navy V-12 Members

WITH their thoughts focused on the immediate job of helping to win the war, and on their absent classmates who are on active duty throughout the world, nearly 250 student-members and a group of outstanding members of the Society attended the student luncheon, in the Winter Garden Ballroom of the Hotel McAlpin, New York, N. Y., on December 1, 1943. Many Navy V-12 men were present, which emphasized the wartime character of this student feature of the Annual Meeting of the Society.

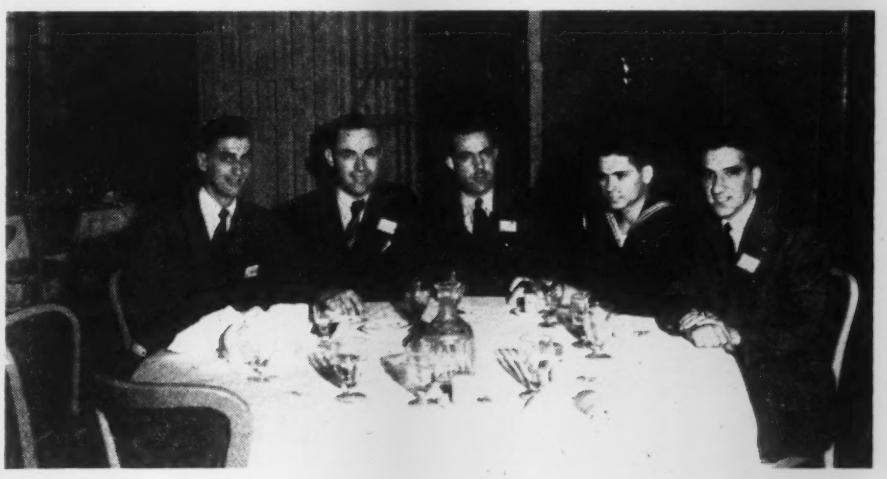
John I. Yellott, Toastmaster

John I. Yellott, chairman of the Committee on Relations with Colleges, recipient of the Pi Tau Sigma medal for 1939, and director of the Institute of Gas Technology at the Illinois Institute of Technology, Chicago, Ill., acted as toastmaster for the occasion. After all had participated in a good luncheon, Toastmaster Yellott introduced past-presidents of the Society who were present. The first was Dr. D. S. Jacobus, who was introduced as "the Dean of all Past-Presidents—a truly great figure in American engineering." Other past-presidents who attended the luncheon were Dean A. A. Potter of Purdue; A. G. Christie of Johns Hopkins University; James W. Parker, The Detroit Edison Company; and Dean D. S. Kimball of Cornell University. Among other notable guests were Harold V. Coes, president of the Society; Col. C. E. Davies, secretary of the Society; the president-elect, Robert M. Gates; two visitors from Canada, K. M. Cameron, president, and L. Austin Wright, secretary, of The Engineering Institute of Canada. Mrs. Lillian M. Gilbreth, member A.S.M.E., was also introduced to the audience.

Mr. Yellott explained that there would be no Pi Tau Sigma awards for the duration of the war so that all who are now in the service will have the opportunity to compete for the awards when victory is won. He then stated: "One of the high lights of the student-member meeting is that the immediate president and the incoming president of the Society are corralled to say something to those who are going to be the up-and-coming members of the Society."

President Coes Talks

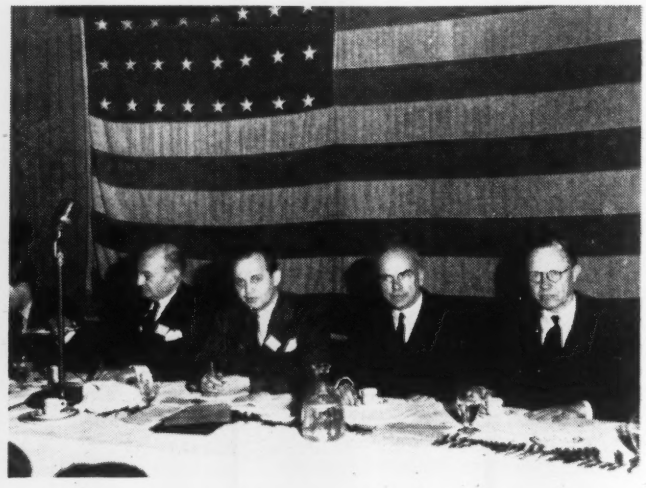
He then introduced President Coes who, in addressing the group, stressed two important factors in engineering at the present time; engineering administration and human relations. Referring to the former he stated that many administrators insist on having all of the facts of a given situation before they act. Like a batter going up to the plate, such a one has many balls tossed to him, but he has to hit one before he can run. Those executives are a menace who procrastinate before they make a decision. At times it is wiser to make a decision without having all of the facts available. On the subject of human relations, he stated that the opportunity will come when the approach to the problems of capital and labor will be made in the realm of human relations. In the past, both groups have been interested only in material things, whereas the attention should be directed to improvement of conditions, and to the effect that they have on the health, happiness, and lives of human beings



AT THE STUDENT LUNCHEON

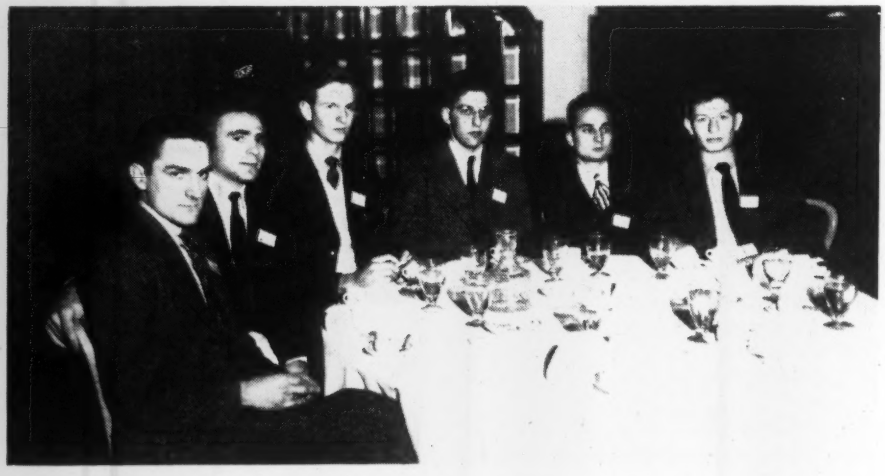
(A. J. Roth, Villanova, J. N. Breen, Villanova, Prof. K. J. Moser, Stevens, E. C. Brennan, A.S., Villanova, and L. J. Eni, Villanova.)

SPEAKERS' TABLE, STUDENT LUNCHEON
(Dr. D. C. Jackson, M. C. Kazen, who received the Charles T. Main Award, and President Coes.)

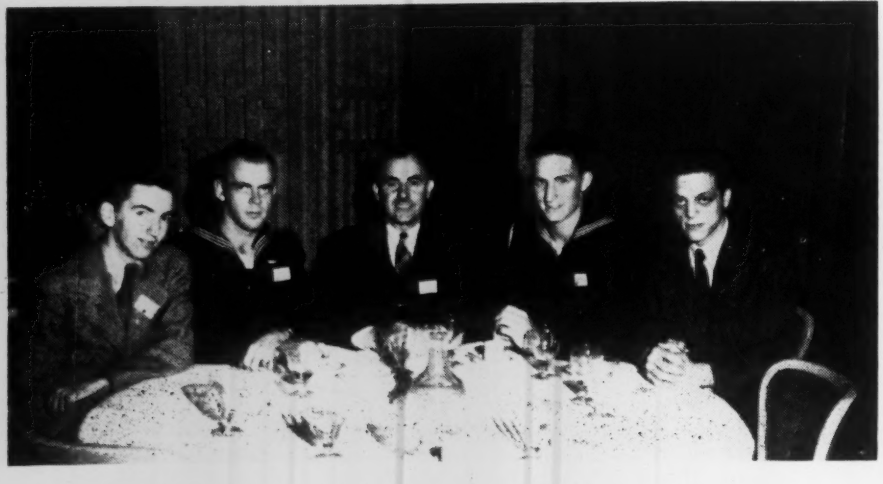


SPEAKERS' TABLE, STUDENT LUNCHEON
President Coes, John I. Yellott, President-Elect R. M. Gates and Past Vice-President K. H. Condit.)

WILLIAM B. BURLINGAME AND HIS HIGH-SCHOOL GUEST, DEAN THORPE
(Mr. Burlingame of Exeter, N. H., brings a student guest to every Annual Meeting.)



AT THE STUDENT LUNCHEON
(Peter Kreitz, M. A. Kreitchman, William Lampe, Leon Marentz, J. E. Aumenta, and M. C. Maxwell, all of Newark College of Engineering.)



AT THE STUDENT LUNCHEON
W. J. Doyle, J. L. Allen, A.S., Prof. J. Stanley Morehouse, F. J. Gerngross, A.S., James Correole, all of Villanova.)

AT THE STUDENT LUNCHEON
(Prof. E. L. Schwartz, Michigan, S. C. Cameron, A.S., and J. F. Frederick of Yale.)

He advised that students should meet and learn to know older members of the Society. It is equally the duty of those of mature years to help the youngsters of the profession carve out a future for themselves that will be well worth while.

D. C. Jackson Awards Prizes

Toastmaster Yellott then introduced Dr. Dugald C. Jackson, consulting engineer and Fellow A.S.M.E., who awarded two prizes. The first prize to be awarded was the Undergraduate Student Award of 1943, to William L. Hutton, Ensign, U.S.N.R. He received his degree in mechanical engineering at Princeton University with the class of 1943, having taken Phi Beta Kappa honors. He completed his naval indoctrination course at Fort Schuyler, N. Y., in May, 1943, and after a short tour of duty at the Brooklyn Navy Yard, was transferred to the Diesel Engine School at The Pennsylvania State College. Having recently completed his training there, he has been assigned to active sea duty. Dean K. H. Condit, of Princeton University, member A.S.M.E., accepted the award for Ensign Hutton saying, "It is a pleasure to accept the award in his behalf. He is the son of one of my classmates. He was the best student chairman we ever had at Princeton." A great round of applause followed this acceptance speech.

Dr. Jackson then awarded the Charles T. Main prize to Mitchell C. Kazen for his paper, "Government as Affected by Engineering." Mr. Kazen is a graduate of the University of Detroit. Throughout his five-year engineering course, he continued to work at night at the Ford Motor Company. At present he is engaged in war-material inspection work at Dearborn, Mich., also doing part-time work as tool designer for the Cook Engineering Company, Detroit. He is a junior member of the Society. Upon accepting the award, Mr. Kazen thanked the Society for granting this award and for making it possible for him to be present at the meeting. He also thanked Col. Davies for giving him his first sleepless night when the letter arrived telling him he had received this prize.

President-Elect Gates Introduced

President-Elect R. M. Gates was introduced and spoke briefly. He said that the student members were, in his opinion, fortunate in being able to enter the engineering profession at a time when it had reached the peak of achievement and opportunity. The war, he said, was a war of engineers—a technological war fought to save a technological civilization. We were fighting this war not only to defeat our enemies but to open wider the door of individual opportunity in peacetime pursuits.

The engineer, Mr. Gates said, stood and worked with his feet in two worlds—those of science and engineering. He closed his remarks by emphasizing six points: The mastery of fundamentals, the habit of straight thinking, the organization of thoughts for presentation of them to others, breadth of interest, the ability to get along with people, and the acceptance of the broad responsibilities of the engineering profession.

Branch Meetings

On October 26, the AKRON BRANCH met to elect a new chairman and vice-chairman. George Marinoff was elected chairman and Robert Shipman, vice-chairman. Mr. Hoffmann, an engineer with the City Water Works and vice-president of the Akron District Society of Professional Engineers, was guest speaker of the evening. He spoke on the method of obtaining registration as a professional engineer in the state of Ohio.

Columbia Branch Holds Election

COLUMBIA BRANCH held a short and informal meeting on November 19, comprising only the older members. Following elections were made: Gregory L. Laserson, chairman, and Bojtech F. Muska, vice-chairman. Future meetings were planned.

COLORADO BRANCH met for a joint meeting with the student A.I.E.E. and the A.S.C.E. groups in the electrical building. Dr. Louis R. Weber of the physics department gave an interesting lecture on the "Cyclotron." Dr. Weber told how the work in the field of the cyclotron was greatly expanded by the cooperative efforts of a number of physicists and engineers. A thorough history of the development of the cyclotron brought out the fact that a great deal of research work has been done on the theory and use of this instrument. The meeting adjourned at 9:15 after which refreshments were served by the A.I.E.E.

The DETROIT BRANCH held its second meeting of the fall semester on November 8. Four movies were shown: an O.W.I. film "Building a Bomber;" "Trees for Tomorrow;" "Bristles to Brushes," a story of the Fuller Brush Company, and "Flow."

On November 9, DUKE BRANCH met. A business meeting was held and plans made for an inspection trip for the Branch to the Duke Power Plant in Charlotte, N. C., on November 22. At a previous meeting, Carl Metz was awarded a $10 check for junior membership in the Society and Joe Myers was awarded an Eshbach's Handbook by the North Carolina Branch for their outstanding work in the Branch for the past year. An interesting movie was shown on "Petroleum and Its Uses."

The GEORGE WASHINGTON BRANCH held a meeting on October 13, when Mr. Rudolf Michel, member A.S.M.E., senior engineer, Bureau of Ships, Navy Department, spoke on "Marine Reduction Gears." Officers for the coming year are: Boyd E. Horne, president; Edgar Berdahl, vice-president; Raphael Cahn, secretary, and Lawrence Oakley, treasurer.

Idaho Branch Elects Officers

The IDAHO BRANCH met on October 26, to elect officers for the fall semester and to organize the Student Branch of the A.S.M.E. The only officer back this year is secretary-treasurer, Robert C. Pointner, who was elected chairman. Robert D. LaRue was elected secretary-treasurer, and H. F. Gauss, member A.S.M.E. and head of the department of mechanical engineering, was elected honorary chairman.

IOWA STATE BRANCH met on October 20, at which time plans were discussed for future activities. Prof. C. T. Grace, member A.S.M.E. and honorary chairman, announced the A.S.M.E. student competition to be held next spring and suggested that students prepare their papers as soon as possible. A picture from Thompson Products Company was shown. On November 3, Mr. Smith announced that the Institute of Aeronautical Sciences had invited all to hear Mr. Case of the Douglas Aircraft Company at the next meeting. Informal talks were given by Messrs. Castner and Morgan of Westinghouse Electric & Manufacturing Company. Mr. Castner, who is manager of the Des Moines territory of the Northwest division of Westinghouse, said a few words and then introduced the vice-president of the Chicago division of the company. This Branch held its first smoker of the fall quarter on November 10, which was given for the Navy V-12 men. Professor Grace spoke briefly and urged nonmembers of the group present to consider seriously the merits of the A.S.M.E. Mr. Dipple, master of ceremonies for the evening, introduced Prof. David L. Arm, member A.S.M.E., who is mainly responsible for the new Navy Diesel School. Professor Arm introduced the faculty to the group.

On November 17, the KANSAS BRANCH met; the meeting being called to order by Mon-Hui King, the secretary-treasurer of the Branch, as the president and vice-president are now in the service. Motion pictures were shown on the manufacture of tanks and bombers. Election of officers for the coming term was then held.

Michigan Branch Hears Mr. Matissa on City of Washington

On November 2, the MICHIGAN MINING AND TECH BRANCH held its meeting at the Tech Clubhouse. The speaker, Mr. Matissa of the U. S. Geological Survey, spoke on the "Glorious City of Washington." Plans were made to invite the air scouts and A.S.T.P. to see the movie "Light Airplane Construction," which will be obtained in the near future.

On October 19, MICHIGAN STATE BRANCH held a joint meeting of all engineering societies on the campus. Mr. Finney of the Highway Test Laboratories, East Lansing, Mich., gave a lecture on the test roads in Michigan.

MICHIGAN UNIVERSITY BRANCH held its initial meeting of the year on November 11. The president, M. Dams, opened the meeting by presenting the new officers. Ivan C. Craw-

DUKE UNIVERSITY STUDENT BRANCH OF A.S.M.E., 1943

ford, dean of the college of engineering, then spoke on the subject, "Collaboration of Engineering Societies During the War." The next speaker, Prof. R. S. Hawley, chairman of the mechanical-engineering department at Michigan University, discussed the national society. Prof. R. Clay Porter, honorary chairman, member A.S.M.E., spoke on "The Importance of the Student Branch." A film "King Cotton" of the General Motors Company film library was then shown. The meeting ended with a mixer and refreshments.

The MISSOURI BRANCH made an inspection trip to the Columbia Municipal Water and Light plant on November 23, which was sponsored by the Student Branch. All mechanical-engineering students were invited. The trip was made by 16 students and Prof. A. H. Burr, of the mechanical-engineering faculty, member A.S.M.E. Both power manufacturing and water processing were observed.

North Carolina Branch Initiates New Members

On October 26, the NORTH CAROLINA BRANCH met to acquaint eligible freshmen and sophomores with the activities and purpose of the A.S.M.E. Prof. Hoefer, the honorary chairman, addressed the group explaining and discussing advantages of being a member of the Student Branch. Initiation instructions were written on the board which were to be carried out before the next meeting. On November 9, this Branch met and initiation was the order of the day. A convenient paddle served as a reminder to complete requirements of initiation within a certain period of time. The principal requirements were: The A.S.M.E. shamrock was to be drawn on stiff white paper and pasted on plywood, with a string attached to wear it around the neck—this to be worn for one week—and during this time, the initiate was to secure the signature of every present member plus faculty members on the reverse side of the shamrock. During this period of time he must carry cigarettes and chewing gum for the members. Each student must complete either of the two projects: (1) Write an original paper on some engineering subject; (2) build a working model of some machine equipment which is identified with engineering. A prize of two dollars is to be given the best project.

The NORTH DAKOTA BRANCH held its first meeting of the fall term on October 21. A film was shown depicting the building of the B-26 U. S. Army medium bomber. A film was also shown on electronics.

On November 5, the third autumn meeting of the OHIO BRANCH featured an interesting talk by Dr. Goss of the department of veterinary medicine who spoke on "The History of Veterinary Medicine."

Purdue Student Branch Hears President Coes

On November 11, the PURDUE BRANCH presented to the members and guests President H. V. Coes of the A.S.M.E., who spoke on "Problems of a Management Engineer." With well-chosen examples he showed the group in vivid pictures the problems into which a management engineer runs and the way he solves them. President Coes gave a few principal marks of executive ability, marks by which he in his experience could tell an executive from someone who pretended to be one: Clarity of thought; orderliness; respect for time; avoidance of divided responsibility; ability to take and give constructive criticism; avoidance of procrastination; basing conclusions and decisions on facts, then acting; avoidance of desk pounding; feeling no sign of weakness to seek help; assumption of responsibility; being inspiring; being fair; being tolerant; possessing good judgment; possessing a sense of humor.

UNIVERSITY OF ILLINOIS STUDENT BRANCH MEETING NOV. 10—SIGNING UP NEW MEMBERS

On November 9, STEVENS TECH BRANCH attended a meeting of the Metropolitan Section of the S.A.E. Student Branch at Cooper Union. George W. Brady, chief engineer of the Curtiss propeller division, Curtiss-Wright Corporation, discussed development of the airplane propeller and presented a paper on "Flight Testing with a Propeller Thrust Meter." A film was shown on "Theory of Operation of Electrically Controlled Propellers."

Inland Waterways and Steel at Tennessee Branch

The TENNESSEE BRANCH held a meeting on November 11, when C. R. Barker, spoke on "The Future of Inland Waterways as a Means of Freight Transportation." He stressed the fact that river transportation is a thing of the future rather than a thing of the past as some people seem to think. Several interesting slides of boats, barges, and landing docks along principal waterways were shown. Mr. Barker stated that Knoxville was now connected by these water routes to Pittsburgh, St. Louis, Chicago, Corpus Christi, and Pensacola. On November 18, the first woman member of the Tennessee Student Branch was introduced to the group, Miss Mary Porter Fain. A film was shown entitled "Steel, Man's Servant." Prof. R. W. Morton, member A.S.M.E. and professor of mechanical engineering at the University of Tennessee, spoke on the advantages of taking part in the A.S.M.E. activities while in college.

Mosquito Airplane Described at Toronto Branch

The TORONTO BRANCH enjoyed a brilliant address given by R. B. McIntyre, member A.S.M.E., and product engineer of De Havilland Aircraft of Canada, on the subject of "The Construction and Design Features of the Mosquito Airplane." Mr. McIntyre stated that the speed and versatility of the machine were not because of any radically new features, but due to careful design, backed by experience. Built of birch, balsa, and spruce, the plane is extremely light and, but for its bombs, entirely unarmed.

The Mosquito is almost a flying power plant, embodying as it does, two Rolls Royce Merlin engines which form a large percentage of the plane's total weight. Its high speed has made it especially adaptable to intrusion raids, and the cockpit design, wherein the pilot is very close to the Perspex windshield has had much to do with its wide use as a night fighter. As a side light on the subject of night fighting, Mr. McIntyre mentioned that a pilot is quite justified in refusing to fly an airplane with a scratched windshield.

Among many other comments which evoked ripples of mirth from the audience was Mr. McIntyre's description of the problem of designing the oil tanks, which must be shaped so as to present no obstruction to the undercarriage struts which are drawn up when the landing gear is retracted. While conceding that descriptive geometry might be helpful, a better method, as suggested by Mr. McIntyre, is the hammering of the tank by a workman standing by as he sees a strut about to strike the tank. When the tank is finally dented to the proper shape it is shipped to the drafting room, where final design is made. Mr. McIntyre illustrated his points with a set of slides depicting the construction of various members of the airplane.

The regular meeting of the ILLINOIS TECH BRANCH was held on September 10. Prof. John I. Yellott, director of the Gas Institute and chairman of the Committee on College Relations, A.S.M.E., spoke on the "Story of a Patent." He explained how his research at Stevens Tech in the study of steam nozzles led to the testing of nozzles for the Worthington Pump Company, how it was noted during the testing that a formation of ice appeared at low pressures which seriously lowered the efficiency. From these observations it was decided to heat the nozzles and by so doing prevent ice formation. The patent is now used all over the world in vacuum pumps and is playing its part in preparation of blood plasma. This Branch held another meeting on October 1, at which time J. Gabriel, vice-president of the Acme Industrial Company, spoke on "Measurements by Light Waves." Mr. Gabriel illustrated his lectures with many interesting slides showing the wave theory behind the subject and the commercial adaptation of this measuring method which can obtain ac-

curacy within one millionth of an inch.

On November 18, the TULANE BRANCH made an inspection tour on the New Orleans Dock Board Yacht "Hugh McCloskey." The forty members making the trip had the opportunity of seeing many of the local shipyards in operation and the trip was very much enjoyed by everybody.

Rose Polytechnic Institute Branch Elects Officers

Meetings were held by the ROSE POLYTECHNIC INSTITUTE BRANCH on November 16 and November 22, 1943. The first meeting, which was called to order by Professor Wischmeyer, was for the purpose of electing officers for the ensuing year. The officers elected are as follows: chairman, Jay Kress; secretary, Harold E. Campbell; treasurer, A. Jack Hief. A new honorary chairman, Edward Eckerman, was elected from the faculty.

At the subsequent organization meeting on November 22, James Dill was elected vice-chairman. A Program Committee composed of Carl Campbell, Robert Larkin, and William Mitchell, with James Dill as chairman, was formed. William Mitchell outlined the work of the Society for the 30 members and guests present. Information was given on the awards for which student members are eligible, and the qualifications necessary for papers submitted.

A special feature of the meeting was the presentation of an excellent film on "Machine-Shop Work."

Utah Branch Wins A Party

On November 4, the UTAH BRANCH enjoyed a party at the expense of rival Student Branches of the A.S.C.E. and A.I.E.E. Each of the three branches posted $5 to be awarded the group bringing the greatest number of technical books for donation to the library of Camp Kearns, Army Air Forces Basic Training Center, near Salt Lake City, Utah. This library had made an urgent plea for technical books. The campaign proceeded with heated fury for two weeks during which each group hid most of their books and left only a token number in the open to deceive the rival scouts. The final score was

	No. of books
A.S.M.E. Branch	149
A.I.E.E. Branch	126
University Library	42
A.S.C.E.	34
	351

Many fine books were contributed and, considering an average value of $2 per book, this amounted to a $700 gift. The "mechanicals" decided to use the winnings in the form of a party which was held in a beautifully situated mountain lodge in a canyon 25 minutes' drive from Salt Lake City. An amplification system and popular phonograph records provided music for dancing either in the lodge or on the open-air plaza. Crackling log fires in the two large stone fireplaces together with a canyon stream, and the moon coming up over the pine trees furnished a thrilling setting. Chicken sandwiches and hot chocolate along with group singing rounded out the evening. Twenty-three couples were present, most of whom were seniors.

The WEST VIRGINIA BRANCH met on September 6 at which time three student papers were presented, "Problems Affecting the Use of Wood in Aircraft," by R. E. Jenkins; "Landing Mats of U. S. Air Forces," by Paul Muffly, and "The Big Inch Pipe Line," by F. C. Pritchard. On September 13, the Branch met to hear another presentation of student papers, "Locks on the Monongahela River," by W. H. Combs; "The Rotal Four-Blade Variable-Pitch Air Screw," by Bernard Judy; "Synthetic Rubber," by Jack Rowe. At another meeting of the Branch on September 20 an interesting student paper, "Rubber, Natural or Synthetic," was presented by Jack Murray.

On September 27 this Branch met again with the general engineering society to see a film showing the collapse of the bridge at Tacoma Narrows, Washington, in 1940. This film was presented by the student branch of the Civil Engineering Society.

UNIVERSITY OF UTAH STUDENT BRANCH OF THE A.S.M.E. FALL PARTY, SEPT. 24, 1943

Yale Branch Holds Second Meeting

The second meeting of the current term was held by the YALE BRANCH on November 16. Four papers were presented as follows: "Labor and Management in War," by R. E. Davis. "The Development of Firearms," by B. Blickman; "War and the Engineer," by H. D. Willis; "Future Trends for Engineers," by Mr. Dahline.

NORTHEASTERN STUDENT BRANCH OF A.S.M.E. AT BANQUET HELD ON NOV. 2

(*First row seated:* R. E. Buck and N. M. Molino, co-secretaries; A. K. Schneider, D. W. Seavy, Prof. C. H. Wolowicz; L. H. Bacon and W. H. Mitchell, co-chairmen; Prof. A. J. Ferretti, F. A. Stearns, faculty advisor; Dean W. C. White, Prof. A. E. Whittaker, J. Profita, treasurer; and J. Connors, vice-chairman.)

United Engineering Trustees, Inc., Report for 1942-1943

Summary of Facts Concerning Finances, Building, Engineering Societies Library, and Engineering Foundation

THE Annual Report of the United Engineering Trustees, Inc., for 1942-1943, was issued on October 28, 1943, by President Albert Roberts. Mr. Roberts' report in somewhat abridged form follows:

The second year of the war has required readjustments in many of our operations. Rising wages and material costs in our case are not offset by increased income. On the contrary decreased use of meeting halls has reduced this. We have been fortunate in having the older employees, who form the backbone of our service to the membership of the Societies, remain with us, displaying their loyalty under trying conditions.

Before proceeding with a factual report, we pause to pay our respects to the memory of Walter Kidde, Trustee member from The American Society of Mechanical Engineers since February 1940, who died February 9th, 1943. In business interests he made notable contributions to the war effort and to the saving of human life. He was very generous of his time in the public interest. He served our Corporation as Treasurer and as Chairman of the Finance Committee. His loss is deeply felt.

We lost through death on July 13, 1943, another esteemed associate, our investment adviser, John Alexander Clark, a partner in Wood, Struthers and Company. His helpful watchfulness over our portfolio over the years brought him very close to many of us who feel a real and personal loss in his death.

Engineering Societies Building

Engineering Societies Building has participated in the war effort in housing war agencies, in being the center of recruitment of engineer companies, and of lectures and classes in Ordnance and other departments of the armed services. The office space in the building has been fully occupied for the entire year and in one case two meeting halls have been rearranged for occupancy as office space "for the duration." On the other hand, hall rentals which have been decreasing for several years show a further decrease due to cancellation of reservations for classes, the students of which had left this vicinity for war work or for the armed forces.

Operating expenses were sharply increased due to higher wage rates for building service employees ordered by the War Labor Board, and by higher costs of maintenance materials. In addition to the usual insurance carried on the property and on the Library, namely, fire, supplemental coverage, liability and compensation insurance, war-damage insurance was taken again this year. Although the probabilities of any damage to the building by air raids were considered remote, nevertheless the Board did not feel justified in failing to carry this special insurance.

The net result of decreased income and increased costs, was a deficit which would have been $11,270.24 had not the Founder Societies accepted the call to make up the greater part of this amount.

The Board has during the past six months made a thorough study of the possibilities of means for increasing income, of effecting economies in operation, and with these as a basis has made a study of changes in the budget which are indicated, to meet the situation.

Engineering Societies Building is reported by insurance inspectors as maintained in excellent condition. No major repairs or alterations were made during this past thirty-seventh year of use.

Financial Matters

The annual audit, the balance sheets and accountant's certificate of which follow this report, shows our finances to be in good condition. The aggregate book value of the capital fund investments, other than real-estate securities, at September 30, 1943, is $1,461,515.49, and the market quotation values thereof on or about that date is $1,494,395.85, or slightly over 102 per cent of the book value.

The real-estate securities have a book value of $122,164.36 and the value as at September 30, 1943, as reported by the Custodian, Chemical Bank & Trust Company, of $62,585.98, or 51 per cent of the book value.

The total market value as of September 30th of said capital fund investments is slightly over 98 per cent of the book value.

It may be noted that our portfolio is composed of trust funds in the amount of $1,167,599.36 and a Depreciation and Renewal fund which has been accumulated over many years, and which, after providing for renewals in the building, today amounts to $474,544.11. This Depreciation and Renewal fund has been augmented during the fiscal year by interest and dividends earned to the amount of $16,655.70, transfer from building operations reserve of $20,000, and gains on reinvestment of capital funds of $3648.93, a total of $40,304.63.

The Corporation acts as custodian for the funds of the John Fritz and the Daniel Guggenheim Medal Boards, and other smaller funds, including contributions from industry to supplement the funds of The Engineering Foundation for research projects directed by them and continues as treasurer for Engineers' Council for Professional Development.

Engineering Societies Library Reports an Active Year

SERVICES rendered engineers and the Government during the past year by the Engineering Societies Library, which holds the combined collections of the four Founder Societies, have been summarized by Harrison W. Craver, director of the Library, in his annual report for 1943. Dr. Craver stated:

Life in the Library during this year has been a continuation of that of 1941–1942, a constant scramble to keep up with a flood of inquiries from members engaged in war work and from departments of the government, all of whom

SUMMARIZED FINANCIAL REPORT, SEPTEMBER 30, 1943

FUNDS AND PROPERTY

Combined Fund:* Summary of Investments September 30, 1943

FUNDS INCLUDED		Book value	Market value
Engineering Foundation Fund		$ 870,789.17	
Edward Dean Adams Fund		88,369.88	
Library Endowment Fund		163,635.88	
Depreciation & Renewal Fund		474,544.11	
Total		$1,597,339.04	
Investments: "Legal"	$ 519,754.22		
Nonlegal	1,019,519.41		
Total Investments Sept. 30, 1943	1,539,273.63		$1,527,036.15
Cash uninvested	10,874.46		
Savings Bank Accounts	47,190.95		
	$1,597,339.04		
Real Estate (Less Depreciation & Renewal Fund Res.)		$1,519,249.81	
Henry R. Towne Engineering Fund Investments		44,406.22	29,945.68
Henry R. Towne Engineering Fund Uninvested Cash		398.21	
The Daniel Guggenheim Medal Board of Award Investments		15,604.28	8,361.23
The Daniel Guggenheim Medal Uninvested Cash		235.72	
The John Fritz Medal Board of Award Investments		3,500.00	3,893.75
United Engineering Trustees, Inc., Operating Assets		8,304.38	
Engineering Societies Library Maintenance Assets		26,861.64	
Library Service Bureau Reserve Fund Investments		7,500.00	8,027.34
The Engineering Foundation—unexpended income		28,292.87	
Alloys of Iron Research—unexpended income		5,548.73	
Welding Research—unexpended income		4,670.13	
The Engineering Foundation Custodian Fund Cash		10,744.11	
United Engineering Trustees, Inc., Custodian Funds—unexpended income		6,384.43	
		$3,279,039.57	

* A group of funds managed as one for convenience and economy in investment transactions.

wanted definite information upon details of manufacturing processes, upon foreign factories, docks, public works, and other matters of military significance. All this information was wanted immediately. Much of it was too novel to have yet appeared in print to any great extent.

One result of the year's experience has been to prove the soundness of the book collection. Our small collection of Japanese books and periodicals has proved the most extensive in the country. Our collection of German works has seldom failed to produce the wanted book. The Library has lent a number of these to publishers who were authorized by the Alien Property Custodian to reproduce them. Our large resources in older works and in files of foreign magazines have proved invaluable in providing material.

As a result, the collection has been used continually by the Army and Navy. Certain of their searchers arrive when we open each morning and work throughout the day. Others come regularly from Washington and other centers to search our files. It is a great satisfaction to be of such use in this emergency.

One result of the war is a growing appreciation of the value of reference libraries as storehouses of knowledge. The necessity for building them up in advance of need has become apparent as never before.

Service to the government has not ended with provision of our books. One assistant was lent to the Army Corps of Engineers for seven months, during which time she organized its cataloging and indexing service upon a satisfactory basis. Another was released for several days a month to act as consultant to the Signal Corps in building up a reference library in Washington. In addition the staff as a whole has constantly been giving freely of its experience and knowledge as occasion arose.

While the Library was used by more people than in the previous year, the number of visitors showed a slight decrease, and the increase was the result of greater use by mail by nonresident members. The number of visitors was 22,260, compared to 23,734 in 1941–1942. The number of other users was 13,579 as compared with 10,648, making totals of 35,839 and 34,382 for the respective years.

The greatest increase was in calls for photostats. This year 3487 orders for photostats and microfilms were received, an increase of 15 per cent. The number of prints made was 38,702 an increase of 23 per cent.

Telephone inquiries numbered 6689, an increase of 10 per cent. The number of borrowers was 1055, an increase of 62 per cent, to whom 1393 books were lent. Letters were written to 2232 members, answering questions that did not call for sustained searching, this being an increase of 30 per cent over the preceding year. In addition, 86 searches and 30 translations were prepared.

The fact that these 13,579 nonvisitors, who used the library without visiting it, constituted 38 per cent of the users is gratifying and shows the extent to which the membership at large is using the collection.

On December 26, 1942, Mr. W. S. Barstow, for many years a member of this Board, died. Mr. Barstow's interest in the Library was deep and had been manifested on many occasions by generous gifts, among them being one of several thousand dollars to repair and restore the bindings of the rare-book collection. He also left a bequest of ten thousand dollars to the Library. His wise counsel and pleasant personality will be sadly missed by the Board and the Director.

The Library suffered another severe loss, on September 13, 1943, through the death of Harrison A. von Urff. For seven years, Mr. von Urff had been in charge of bibliographic work. During that time hundreds of members had learned to know his great skill in locating printed information and to admire his modesty and quiet helpfulness. His unusual talent for this work will be hard to replace.

Acquisitions

The tendency toward reduction in book output which was noted in the preceding report has continued. The technical publishers have been kept busy by the demands of the Army and Navy for enormous numbers of elementary textbooks for training the forces. In addition, most engineers who would normally be writing are too busy to do so. A further difficulty has been scarcity of paper and binding materials.

This situation, plus the impossibility of getting European books, has resulted in fewer books being added to the Library. While the number of books and pamphlets received (10,286) was almost as many as in the preceding year, the number adjudged worthy of permanent preservation was only 2010, as compared with 5523 in that year. This reduction accurately reflects the effect of the war upon technical publication.

During the year the staff reviewed 420 books for the periodicals of the Founder Societies.

At the end of the year the library contained 156,780 volumes, 7872 maps, and 4565 searches, a total of 169,216 items.

As in former years, the Library has been the constant recipient of gifts from members and friends. To mention all of these in detail is impracticable, but a few of unusual extent may be noted:

The estate of John R. Freeman presented the major portion of Mr. Freeman's professional library, consisting of thousands of reports and books collected during a long busy life and covering the varied branches of civil engineering in which he had been eminent. Other large gifts included a large collection of periodicals from Mr. Pope Yeatman, another from Mrs. C. Minot Weld, and a third from Mr. Charles N. Green. Mr. George H. Gibson presented a useful collection of American and German periodicals. Mr. Ernest P. Goodrich also added materially to our resources, as did Spencer, White and Prentis, Inc., Mr. T. G. Townsend, and Mr. Joseph Meltzer. The McGraw-Hill Publishing Company, Inc., presented many hundreds of books which had come to its editorial offices for review purposes.

To these and other donors our hearty thanks are given.

Expenditures amounted to $42,642.25 of which $6442.75 was spent for books, periodicals and other equipment of permanent value.

Service Bureau receipts were $14,415.24 and expenses were $11,162.64.

Finance

The budget for general operation was $50,000 of which the following amounts were provided by the Founder Societies, on a membership basis:

American Society o Civil Engineers	$10,132.10
American Institute of Mining and Metallurgical Engineers	8,227.10
American Society of Mechanical Engineers	9,471.20
American Institute of Electrical Engineers	10,501.70
	$38,332.10

The Engineering Foundation Reports for the Year

IN their annual report to the United Engineering Trustees, Inc., A. L. J. Queneau, chairman, and E. H. Colpitts, director, The Engineering Foundation, stated:

The Engineering Foundation, established in 1914, completed its twenty-ninth fiscal year on September 30, 1943.

The accompanying financial statement summarizes the present capital funds of the Foundation, the income and the expenditures

SUMMARY OF FINANCIAL RESOURCES

CAPITAL FUNDS

Endowment, total book value September 30, 1943	$959,000.00
E. H. McHenry bequest in hands of executors during life of two beneficiaries, appraised at probate of will in 1931, approximately	400,000.00

The capital funds are held and administered by United Engineering Trustees, Inc. The net income from endowment was $34,812.33 for the fiscal year ended September 30, 1943. The Foundation Board has discretion in use of income. For many of the enterprises which the Foundation has aided, large contributions of money, services, and materials have been obtained from others. Money "contributions" from organizations and individuals, for specific activities, passed through the Foundation's accounts from its organization to September 30, 1943 totaled $623,949.67

EXPENDABLE RESOURCES—SUMMARY

Balance October 1, 1942		$ 24,922.69
Receipts		
Income from endowment	$34,812.33	
Income from minor items and refund	348.05	35,160.38
Total resources		$ 60,083.07

DISBURSEMENTS—SUMMARY

Research Projects	$27,865.70	
Promotion of research and administrative expense	3,924.50	
Total for furtherance and support of research		$ 31,790.20
Balance September 30, 1943		$ 28,292.87

during the year. The book value of the capital funds of the Foundation on September 30, 1943, was $959,000 compared with $952,000 on September 30, 1942. The income for the fiscal year 1942-1943 was $35,160.38 as compared with $34,274.09 for the previous year 1941–1942. For the fiscal year 1942–1943 disbursements amounted to $31,790.20 as compared with $31,430.36 for year 1941–1942. The balance on September 30, 1943, was $28,292.87 compared with $24,922.69 on September 30, 1942.

As stated in previous annual reports, it has been for many years the policy of the Foundation to contribute to a considerable number of projects in diverse fields of engineering. In general the attempt is made to select projects of a fundamental type which normally would not be undertaken by industrial research organizations, or otherwise in certain cases where a group of industries are concerned, to furnish merely such support to a project as enables the Foundation to serve, as it were, as a catalyzing agent for the undertaking whose main support is from contributions by industry. While this policy of the Foundation has been continued for the year 1942-1943 projects have also been scrutinized with regard to their bearing on the war and have been encouraged only in so far as they appeared to contribute to the war effort. Due to the Government's willingness to support research projects demonstrated as important to the war effort and due to the withdrawal of research personnel to more direct war effort the immediate demands upon the Foundation's income for the support of research projects helpful to the national cause seem likely to decrease. However, in the years following the war it is certain that engineering research in many fields should be encouraged and expanded. Consequently in those years the Foundation could doubtless employ a much larger income than will almost surely be available from its present capital funds.

During the year, work on fourteen projects has continued. For the ensuing year grants were recommended for continuation of work on six projects and the initiation of one new project.

The following projects are those in which the A.S.M.E. is particularly interested:

Critical-Pressure Steam Boilers. Project No. 50. Chairman, Prof. H. L. Solberg, Purdue University, Lafayette, Indiana.

While some of the work of this committee was not supported by the Foundation during the fiscal year 1942-1943 it seems suitable to include in the following statement certain closely related items under cognizance of this committee. This is particularly appropriate as certain work is an extension of projects previously supported, at least in part, by the Foundation.

Papers were presented at the December, 1942, meeting of The American Society of Mechanical Engineers and published in the Transactions of the A.S.M.E.:

1 "Corrosion of Unstressed Specimens of Alloy Steel by Steam at Temperatures up to 1800 F," by G. A. Hawkins, H. L. Solberg, J. T. Agnew, and A. A. Potter, Transactions of the A.S.M.E., vol. 65, 1943, pp. 301–308.

2 "The Dynamic Viscosity of Nitrogen," by W.L . Sibbitt, G. A. Hawkins, and H. L. Solberg, Transactions of the A.S.M.E., vol. 65, 1943, pp. 401–405.

The paper on the viscosity of nitrogen was made possible by the support of The Engineering Foundation for the year ending September 30, 1942, and has resulted in a request by another agency for a proposal covering an extensive project on the viscosity and thermal conductivity of pure gases, mixtures of gases, and vapors, to be conducted at Purdue University. The paper on corrosion was based largely on research work financed by The Babcock & Wilcox Co. and is an extension of earlier work for which The Engineering Foundation contributed financial support.

Temperature Distribution in Tube Walls Subjected to High Rates of Heat Input. A new research of a fundamental nature dealing with the temperature distribution in tube walls subjected to high rates of heat input has been initiated during the current year with financial assistance from The Engineering Foundation. A tube section $1\frac{1}{2}$ in. OD by $\frac{1}{4}$ in. wall thickness has been equipped with various types of surface and depth thermocouples and has been subjected to high rates of heat input in order to obtain data and experience concerning the best ways of measuring the temperature gradient in tube walls. Satisfactory methods of measuring inside surface temperatures in tubes operating under high pressures have been developed. Depth thermometers have been installed in a constant temperature field in a tube wall and have proved to be reliable and accurate. The preliminary tests have indicated that the heat flow as calculated from the temperature field in the tube wall checks well with the heat flow as determined by using the tube section as a calorimeter. On the basis of results obtained from these preliminary tests, the final apparatus consisting of burner and combustion chamber, test specimens, supports, and measuring equipment, is now being built.

Corrosion of Alloy Steels by High-Temperature Steam. While The Engineering Foundation did not contribute funds to this project during the year 1942–1943, the Foundation helped to support it over a period of years until it could be financed by contributions from industry and this report is made as a matter of record.

Tests on unstressed specimens of alloy steels containing up to 27 per cent of chromium in contact with steam for 500 hours at 1400, 1500, 1600, 1700, and 1800 F have been completed. Analyses have been made of the various layers of heavy scale which were formed on specimens of 3 Cr-Moly, 4–6 Cr-Moly, 7 Cr-Moly, and 9 Cr-Moly at temperatures of 1500 and 1700 F in an effort to increase existing knowledge concerning the mechanism of scale formation. The results of this investigation were presented at the December, 1943, Annual Meeting of The American Society of Mechanical Engineers in a paper entitled, "The Corrosion of Alloy Steels by High-Temperature Steam," by G. A. Hawkins, J. T. Agnew, and H. L. Solberg. This paper was presented at a session sponsored jointly by the A.S.M.E. Power Division and A.S.M.E. Special Research Committee on Critical-Pressure Steam Boilers.

Material shortages have delayed construction of the apparatus which will be used on the 5000-hour stress rupture tests of alloy steels in a steam atmosphere at 1200 F. These difficulties have been overcome and the tests are now in progress.

The Coefficient of Linear Expansion of Alloy Steels. At the suggestion of one of the manufacturers of high-temperature superheaters, apparatus was built and tests were conducted to determine the coefficient of linear expansion of alloy steels at temperatures up to 2000 F. This equipment, consisting of the usual type of linkages used for elongation measurements and some creep testing, failed to produce consistent results. Careful analysis of the limitations of this type of equipment and a thorough survey of the literature has led to the conclusion that a variable-condenser electron voltmeter combination or an interferometer unit will be used for obtaining precise and reproducible measurements. As a result of this study, it is believed that much of the lack of agreement in the literature on linear coefficients of expansion is due to the use of improperly designed apparatus. This work is being financed by Purdue University.

Plastic Flow of Metals (formerly Rolling of Steel). Project No. 68. Chairman, Dr. A. Nadai, Westinghouse Research Laboratories, East Pittsburgh, Pennsylvania.

It will be noted that the former "Special Research Committee on Rolling of Steel" has been renamed "Special Research Committee on Plastic Flow of Metals."

Progress on this project in part supported by the Foundation is covered by the statement:

Work on Rolling of Steel Investigation Completed. Dr. C. W. MacGregor at Massachusetts Institute of Technology, Cambridge, Mass., has completed an experimental investigation on the distribution of strains in bars which have been rolled. The results of this work were presented at the Plasticity Session of the A.S.M.E. Annual Meeting in New York, N. Y., on December 2, 1942, in a paper entitled "The Distribution of Strains in the Rolling Process" submitted by C. W. MacGregor and L. F. Coffin, Jr., and published in the *Journal of Applied Mechanics*, Trans. A.S.M.E., vol. 65, 1943, pp. A-13 to A-20.

The authors have determined experimentally the states of strain in the compressed region of bars under the pressure of the rolls. Distortion was carefully recorded and the authors found that sequence of rolling operations considerably influences the mode of distortion.

Work on Penetration Process and Effects of Speed of Deformation on Yielding and Fracture Started. A grant of $800 for 1942-1943 was obtained from The Engineering Foundation under the condition that an additional similar amount be raised from other sources. During the fall of 1942 an application for additional funds was submitted to the National Defense Research Committee in Washington, D. C. This application has been acted upon favorably and details of a contract have been arranged with representatives of the National Defense Research Committee and of the Westinghouse Research Laboratories in East Pittsburgh. According to this agreement an additional amount of $7000 becomes available for 1943 from the funds of the National Defense Research Committee for an investigation on the dynamic stress-strain characteristics of steels.

A research assistant was appointed in February, 1943, whose work is supervised by the N.D.R.C. Apparatus for tension tests to be made with mild steel under controlled conditions has been designed and built. Some penetration tests have been made and more tests are contemplated. Work is under the guidance of the chairman. A confidential report on this work will have to be submitted to the N.D.R.C.

Work on Friction Under Extreme Pressures at Elevated Temperatures Started. For the years 1941 and 1942, $1600 had been granted by The Engineering Foundation for this investigation in which The American Society of Mechanical Engineers Research Committee on Lubrication is also partially interested. Through the efforts of Prof. George B. Karelitz of Columbia University several companies of the oil industry had been approached for additional funds. Through the untimely death of Professor Karelitz in January, 1943, these negotiations have been delayed by several months; however, during March, 1943, Dr. Raymond Haskell of The Texas Oil Company (New York Office) has taken up the interrupted contacts with the oil industry. Through the efforts of Dr. Haskell five companies of the oil industry have agreed to support this investigation with an additional amount of $1000 during 1943. The chairman of the Committee met with representatives of The Texas Oil Company, Shell Company, Atlantic Refining Co., and Standard Oil Co. of New Jersey in New York, Washington, and Pittsburgh and discussed with them the plans for the tests. Work was started in Pittsburgh in June, 1943, where at present a research engineer is designing an apparatus for observing of the friction at high temperatures. All facilities for these tests and the equipment are furnished free of charge by the Westinghouse Research Laboratories.

New Project on Stress-Strain Relations in Various Drawing Processes. The committee has recommended this project, submitted by Dr. G. Sachs, professor at Case School of Applied Science in Cleveland, for a grant of $1500 for the fiscal year 1943-1944 and it is awaiting final action by The Engineering Foundation.

Plasticity Sessions. At the last Annual Meeting of The American Society of Mechanical Engineers a special session of the Applied Mechanics Division on "Plasticity" was again arranged for under the sponsorship of this committee and the following papers were presented:

1 "Creep and Relaxation of Oxygen-Free Copper," by E. A. Davis, published in the *Journal of Applied Mechanics*, Trans. A.S.M.E., vol. 65, 1943, p. A-101.

2 "A Principle of Maximum Plastic Resistance," by M. A. Sadowsky, published in the *Journal of Applied Mechanics*, Trans. A.S.M.E., vol. 65, 1943, p. A-60.

3 "The Distribution of Strains in the Rolling Process," by C. W. MacGregor and L. F. Coffin, Jr., published in the *Journal of Applied Mechanics*, Trans. A.S.M.E., vol. 65, 1943, p. A-13.

Fluid Meters. Project No. 30. Chairman, R. J. S. Pigott, Gulf Research & Development Co., Pittsburgh, Pa.

The Foundation made its first grant to this project for the fiscal year 1942-1943. While the general project has been under way for several years the portion of the work probably of most interest to the Foundation relates to "Research on Volume Meters" which is a joint undertaking of The American Society of Mechanical Engineers and the American Petroleum Institute.

This research has made headway despite the hindrance from the war, and a certain series of tests have been made on a group of meters submitted by several manufacturers. These tests were made with three grades of oil and with gasoline as calibrating mediums and in addition displacement values of the metering elements have been determined.

The Committee sponsored a "technical session" at the Annual Meeting of The American Society of Mechanical Engineers in December, 1942, at which the following papers were presented: "Results of Tests on Volumeters for Liquid Hydrocarbons," by Messrs. R. J. S. Pigott, E. E. Ambrosius, and E. W. Jacobson, published in Transactions of the A.S.M.E., vol. 65, 1943, pp. 350–352, "Developments in the Measuring of Pulsating Flows with Inferential-Head Meters," by Messrs. S. R. Beitler, E. J. Lindahl, and H. B. McNichols, published in Transactions of the A.S.M.E., vol. 65, 1943, pp. 353–356, and "The Effect of Installation on the Coefficients of Venturi Meters," by Prof. W. S. Pardoe, published in Transactions of the A.S.M.E., vol. 65, 1943, pp. 337–349.

Furnace Performance Factors.

Project No. 82. Chairman, A. R. Mumford, Combustion Engineering Company, Inc., Chattanooga, Tennessee.

The Foundation made its first grant to this project for the fiscal year 1942-1943 and the work of the committee having this project in charge has for the year largely concerned organization, formulation of program, and solicitation of additional support to cover two years' work.

Unsteady-Heat-Flow Investigations by Electrical Analogy. Project No. 80. Division Chairman, Carl F. Kayan, Columbia University, New York, N. Y.

Heated and Cooled Enclosures, Heat Transfer Division. This project has been continued over the fiscal year 1942-1943, and the research equipment now known as the "Heat and Mass Flow Analyzer" has already taken its place in the technical world as a very important research tool. Meanwhile studies are under way to further improve this method and the apparatus embodying the same.

Chicago Technical Societies Council Formed

MORE than 25 local sections of national technical societies and state societies in the Chicago area, including The Western Society of Engineers, have organized The Chicago Technical Societies Council.

According to an announcement recently received, "the Chicago War Production Clinic, staged at the request of W.P.B. by the various engineering societies on March 11, 1943, was a demonstration of what could be accomplished by co-operative effort. The outstanding success of this venture definitely indicated the need for, and benefits to be derived from, co-operative action, and pointed out the desirability of extending the scope of this effort to include further intersociety activities, both present and postwar, and technical civic endeavors, as well as efforts in behalf of the war effort."

It is further stated that the Council will not duplicate any of the activities or overlap the functions of its member groups but will perform a service for them that is beyond the scope of any individual group.

The chairman of the Chicago Technical Societies Council is Thomas S. McEwan, manager, A.S.M.E. Other officers are: B. E. Schaar, vice-chairman; K. H. Hobbie, corresponding secretary; P. S. Smith, recording secretary; and G. P. Halliwell, treasurer. There is a board of directors of six members and 14 committees are listed in the announcement. Thomas S. McEwan and J. R. Michel represent the Chicago Section, A.S.M.E., on the Council.

Hawaii Hears Lecture on Paper

ON October 21, the Engineering Association of Hawaii held a luncheon meeting. The speaker was Mr. Charles T. Oliphant whose subject was "Paper." Mr. Oliphant began with a brief historical review of paper. Paper, he said, is not new; it was first made by the Chinese about 2000 years ago. Thence it traveled westward. It was made by the Arabs about 1100 A.D. It reached Spain around 1150; France, 1189; and England, 1494. Two hundred years later the industry reached America.

The Chinese first used silk fibers for a binder. Later, vegetable fibers from the bark of the mulberry tree were employed. The employment of linen fibers—an important development—is accredited, for the first time, to the Arabs. It was still later that the use of cotton fibers for a binder was developed was in Europe.

The wood-pulp paper industry began early in the 19th century. An observing Frenchman was watching some wasps building their paper-like nests: "What wasps can do," he reasoned correctly, "men, also, could do." That idea, the product of observation and intelligence, set in motion an industry which today, in America alone, is valued at $2,000,000,000 annually; produces nearly 19,000,000 tons of paper products; and employs more than 500,000 workers. Prior to the war, Mr. Oliphant stated, the Territory consumed some 18,000 tons of paper annually. Today this figure is far exceeded. The tonnage of America's paper industry is divided roughly into 80 per cent wood-pulp and 20 per cent rag and rag-content papers. Today, we were told, there is a shortage of 1,725,000 tons of wood pulp. By spring, it is estimated the shortage will have reached 40 per cent. The problem, the speaker said, could be solved by 20,000 woods workers. Unless these are made available, the paper industry will be paralyzed for the duration. The use of war prisoners to supply this labor need has been advocated. Canada has already allocated some 500 prisoners to this work.

Labor shortage is not the whole story, however, behind the growing paper shortage. Allocation of pulp by the Government is also a contributing factor. Some mills, unfavorably located geographically, have had to shut down for lack of pulp. The product of some mills goes into explosives; that of others, into plastics. The maw of these mills must be kept filled. Paper, commercial paper, takes the rap. Another source of our growing paper shortage is the Army "V" cartons.

The Army V-1 carton, Mr. Oliphant explained, has a bursting strength, dry, of 750 psi. These Army V cartons, as the figures indicate, are very stout. They are, in addition, waterproofed. They must withstand an immersion test for 24 hr in water of between 70 and 80 F. Thus in landing operations they can be dumped overboard and later recovered by the troops—intact. They must, in addition, meet a rigorous "drop test."

S.A.M. "Gilbreth Day" Meeting, January 18, Chicago

THE Chicago chapter of the Society for the Advancement of Management will hold a "Gilbreth Day" Meeting on January 18, 1943, with dinner at 6:15 p.m., at the Medinah Club, 505 North Michigan Boulevard, Chicago, Ill.

Thousands of managers and engineers have seen "before" and "after" motion-study pictures which involved applications of Gilbreth's motion-economy principles but none have seen the "Original films of Frank B. Gilbreth." From the Gilbreth film library of over 200,000 feet of film, a number of classic studies will be presented at this meeting.

Speakers at the meeting will include Dr. Lillian M. Gilbreth, Wallace Clark, Professor Ralph M. Barnes, and James S. Perkins.

A.I.M.E. Elects Officers

THE American Institute of Mining and Metallurgical Engineers has announced the election, by letter ballot of its members, of president, two vice-presidents, and six directors. The officers elected are:

President, Chester Alan Fulton, president of the Southern Phosphate Corporation, Baltimore, Md.

Vice-presidents, John Livermore Christie, metallurgist and manager, Handy and Harmon, Bridgeport, Conn.; and J. Robert Van Pelt, Jr., geologist and technical director, Museum of Science and Industry, Chicago, Ill.

Directors, Milton H. Fies, mining engineer and vice-president in charge of mining division, De Bardeleben Coal Corporation, Birmingham, Ala.; H. T. Hamilton, assistant to the president, The New York Trust Company, New York, N. Y.; J. C. Kinnaer, mining and metallurgical engineer, general manager, Nevada Mines Division, Kennecott Copper Corporation, McGill, Nev.; Wallace E. Pratt, geologist, vice-president, Standard Oil Company of New Jersey, New York, N. Y.; John R. Duman, vice-president in charge of production, Humble Oil and Refining Co., Houston, Texas; and Robert W. Thomas, general manager, Nevada Consolidated Copper Corporation, Ray, Ariz.

L.E.S. Meets in New Orleans, Jan. 13–15

THE Ninth Annual Meeting of the Louisiana Engineering Society will be held, together with the meetings of the Local sections of the national societies, at the St. Charles Hotel, January 13, 14, and 15, 1944, in New Orleans.

In conjunction with the meeting will be held War Production Conferences in co-operation with the War Production Board. Registration will begin at 9:00 a.m., January 13, and the first sessions of the meetings will begin at 1:30 p. m.

Engineering Societies Personnel Service, Inc.

These items are from information furnished by the Engineering Societies Personnel Service, Inc., which is under the joint management of the national societies of Civil, Electrical, Mechanical, and Mining and Metallurgical Engineers. This Service is available to members and is operated on a co-operative, nonprofit basis. In applying for positions advertised by the Service, the applicant agrees, if actually placed in a position through the Service as a result of an advertisement, to pay a placement fee in accordance with the rates as listed by the Service. These rates have been established in order to maintain an efficient, nonprofit personnel service and are available upon request. This also applies to registrants whose notices are placed in these columns. All replies should be addressed to the key numbers indicated and mailed to the New York office. When making application for a position include six cents in stamps for forwarding application to the employer and for returning when necessary. A weekly bulletin of engineering positions open is available to members of the co-operating societies at a subscription of $3 per quarter or $10 per annum, payable in advance.

New York	Boston, Mass.	Chicago	Detroit	San Francisco
8 West 40th St.	4 Park St.	211 West Wacker Drive	100 Farnsworth Ave.	57 Post Street

MEN AVAILABLE[1]

ASSISTANT MANAGER, graduate engineer, with 29 years' varied experience in industrial and power plants. Directed layout, design, estimating, scheduling and handled client and public relations on many projects. Me-821.

MECHANICAL ENGINEER, 28, with background of 10 years' training in installation, estimating, and purchasing in plumbing, heating, and process piping industry. Desire position with piping or plumbing contractor offering postwar opportunities. Me-822.

[1] All men listed hold some form of A.S.M.E. membership.

EXECUTIVE, CHEMICAL, AND MECHANICAL ENGINEER, 47, with 23 years' experience. Desire position as chief or plant manager for postwar and war work. Experienced in design, operation, construction, alteration, production layout, all-around general business knowledge chemical, mechanical line. Me-823.

MECHANICAL ENGINEER with 25 years' experience power-plant operation; excellent background as chief engineer, operating and safety; competent, executive ability, with an understanding of labor. Record of economical and efficient operation. Employed, available 30 days. Me-824.

GRADUATE MECHANICAL ENGINEER, 60. Chief engineer in charge of development, plant maintenance, power, design, production, etc. Ability in handling men and organizing for efficiency. Past 38 years in cotton mills, bleachery, power plant, bag manufacturing, heating and air conditioning. Desire position as executive engineer. Now employed in South. Me-825.

INDUSTRIAL ENGINEER available as chief industrial engineer, plant manager, assistant plant manager. Wide background in management and control of business resulting from 22 years' industrial plant experience covering supervision, production control, cost control, cost reduction, foreman training, preparation of standard practice instructions, time and motion study, work simplification, job classification, wage and salary administration, plant layout, engineering investigations, standards, budgetary control. Me-826.

GRADUATE MECHANICAL ENGINEER, 30, draft-deferred, with broad experience in administrative and technical functions of machine and steel fabrication shop and manufacturing. Desire position in production, purchasing, sales, or administrative capacity with future. Me-827.

POSITIONS AVAILABLE

MECHANICAL OR COMBUSTION ENGINEER, CHEMIST, CHEMICAL ENGINEER interested in research of coal utilization and combustion. Salary open. Location, Ohio. W-2164.

ENGINEERS. (*a*) Mechanical engineer experienced in power-plant design. While work is not all on the board, applicant will be expected to do some designing and drafting. $4200–$4500 year. Permanent. Connecticut. (*b*) Piping draftsman experience power-plant piping. $3600 year. Connecticut. W-3011.

MECHANICAL ENGINEER, 30–50, with production experience, to work in plant-engineering department on production-machinery layout, conveying systems, and special technical assignments. Permanent with good opportunity. $4500–$6000 year. Ohio. W-3022.

SALES MANAGER, about 40, graduate mechanical engineer, with knowledge of machine-shop practice for company doing mass production and job-shop machine work. $10,000 a year. Permanent. New York, N. Y. W-3024.

MANAGEMENT ENGINEER, executive assistant. Should have previous experience with firm of industrial management engineers. All-around general business knowledge desirable in many diversified industries. Must have good personality and gain confidence of clients. Some travel. $7500–$10,000 year. Headquarters, New York, N. Y. W-3025.

TESTING ENGINEER, either graduate mechanical, chemical, or electrical. Should be qualified to analyze problems in their respective places of engineering and write clear, concise reports of findings. $3600–$6000. Permanent. New York or Middle West. W-3027.

GRADUATE MECHANICAL ENGINEER, young, with 6 to 8 years' experience in design. Duties will be to act as junior production design engineer in connection with hard-line merchandise, such as refrigerators, toasters, domestic irons, etc. Knowledge of both metal and plastic materials of construction. $4200–$5200 year. Interviews, New York, N. Y. W-3028.

ASSISTANT PLANT MANAGER, mechanical engineer, with factory experience, to take charge of what might be termed nonchemical phases of operations. Prefer man with considerable

amount of factory experience who can pick out spots in which improvements are necessary. Should have persistance and initiative. Ninety per cent of time will be spent in plant. $7500–$8000 year. Indiana. W-3034.

ENGINEER, mechanical-engineering background, to analyze war inventions of mechanical-engineering character and make recommendations as to their worthiness for investigation. Certain amount of commercial experience and fairly wide experience and background in mechanical field necessary. Washington, D. C. W-3043.

WORKS MANAGER for company manufacturing leather goods. Prefer experience in handling goods or similar materials rather than metals. $10,000–$12,000 year. York, N.Y. W-3064.

RESEARCH ENGINEER, preferably graduate mechanical, to work on heating, ventilating, and air conditioning. Some board work. $4160 year. Permanent. New York, N. Y. W-3067.

GRADUATE MECHANICAL ENGINEER with considerable experience in plant operation. Will be required to act as project supervisor in machine-tool plant. Must be able to assist designers in tooling product and follow through production, ironing out all difficulties. $4500–$5200 year. Connecticut. W-3068.

PROJECT ENGINEER, graduate, to supervise and direct development of engineering and equipment projects for steel-production plants. Must know plant and equipment layout and economics, equipment and design and processing. Should have ability to analyze engineering problems, reach sound conclusions, prepare concise reports on recommendations covering physical and monetary factors. $5000–$6000 year. New York State. W-3083.

GRADUATE MECHANICAL ENGINEER with considerable experience with varied type of design. Must be capable of assigning project and following through construction. Will be responsible for drafting room in connection with research program. Thorough knowledge of manufacturing methods and processes. Salary open. New England. W-3106.

DESIGNERS, preferably graduate mechanical engineers, with some experience in design of heavy machinery, such as steel-fabricated bodies for tractor-driven construction equipment. Must be highly qualified men thoroughly capable of design and calculations. Must conduct work without supervision. Permanent. New York metropolitan area. W-3108.

INDUSTRIAL ENGINEER, preferably with experience in time study and incentive wage systems, in machine shops for work with firm of management consultants. $6500–$7500 a year. Headquarters, New York, N. Y. W-3118.

SALES ENGINEER, preferably chemical or mechanical, with some experience in connection with either power plant or water conditioning. $3000–$4200 year with bonus opportunities. Considerable traveling. Headquarters, New York, N. Y. W-3125.

MECHANICAL DESIGNER with considerable experience in layout of intricate machinery. Must have creative imagination and be able to visualize and design mechanisms from written specifications. Chemical-process equipment. Salary open. Pennsylvania. W-3130.

TECHNICAL WRITER. Must be capable of writing technical data in connection with heat insulation materials. Should have some experience in this field and be acquainted with heat-loss calculations. Permanent. About $3600 year. New York, N. Y. W-3134.

A.S.M.E. Local Sections

Coming Meetings

Anthracite-Lehigh Valley. January 28. Elks Club, Berwick, Pa. at 8:00 p.m. Subject: "Railroad Equipment, Wartime Design and Postwar Ideas," by E. D. Campbell, vice-president, American Car and Foundry Co., New York, N. Y.

Baltimore. January 24. Engineer's Club of Baltimore, 6 West Fayette St., Baltimore, Md., at 8:15 p.m. R. M. Gates, president, A.S.M.E. will address the Section members.

Birmingham. January 25. Tutwiler Hotel, Birmingham, Ala. at 8:00 p.m. Subject: "Aircraft Structures, Past, Present, and Future," a nontechnical lecture by Prof. John E. Younger, professor and chairman of mechanical engineering, University of Maryland, College Park, Md.

Buffalo. January 18. Hotel Markeen, Buffalo, N. Y. Dinner at 6:30 p.m., meeting at 8:00 p.m. Subject: "Electronics," by a speaker from the Westinghouse Electric & Manufacturing Co.

Chicago. January 10. Central Y. M. C. A. at 7:30 p.m. Subject: "Air Transport, Past and Future," by W. W. Davies, research engineer, United Air Lines, New York, N. Y.

Cleveland. January 13. Cleveland Engineering Society Rooms at 8:00 p.m. Subject: "Big Inch," by D. F. Sears, chief of pipe line, engineering section, transportation division, Petroleum Administration for War.

Hartford. January 12. Trinity College, Chemical Auditorium at 8:00 p.m. Subject: "How Many Kinds of Fluorescent Lighting Are There?" by Dr. Samuel Hibben, director of research and engineering, Westinghouse Electric & Manufacturing Co.

Milwaukee. January 12. Outstanding speaker on "Electronics."

Ontario. January 10. Royal York Hotel, Toronto, Ont. at 7:30 p.m. Joint meeting of the Ontario Chapter of the A.S.H.&V.E. and Ontario Section, A.S.M.E. Subject: "Air Conditioning of Multiroom Buildings," by Willis H. Carrier of the Carrier Corporation, Syracuse, N. Y.

Philadelphia. January 25. Philadelphia Engineers Club at 7:45 p.m. Dinner at Engineers Club before meeting at 6:15 p.m. Subject: "Engineering Materials of the Future," by A. Allen Bates, manager of chemical and metallurgical division of Westinghouse Electric & Manufacturing Co., Research Laboratory.

Providence. January 4. Engineering Society Building, 195 Angell St., Providence, R. I., at 8:00 p.m. Subject: "Electronics in Industrial Control," by R. H. Rogers, Industrial Engineering Division, General Electric Co., Schenectady, N. Y.

Raleigh. January 28 and 29. Sir Walter Raleigh Hotel, Raleigh, N. C. Joint meeting with North Carolina Society of Engineers. Subject: "Postwar Planning."

San Francisco. January 6. Engineers' Club of San Francisco, 206 Sansome St., San Francisco, Calif., at 6:30 p.m. Subject: "Dia-Indicators," by J. C. Fletcher, Federal Products Corporation. Moving-picture films will be shown.

January 27. Engineers' Club of San Francisco, 206 Sansome St., San Francisco, Calif. at 6:30 p.m. Subject: "Power Development on the West Coast," by George C. Tenney, president, McGraw-Hill Publishing Co., Inc., of Calif.

West Virginia. January 25. The Daniel Boone Hotel, Charleston, W. Va. at 8:00 p.m. The meeting will be preceded by a dinner, held in honor of the speaker of the evening, which will be held in the Daniel Boone Hotel at 6:30 p.m. This meeting will be a joint meeting of the West Virginia Sections of the A.S.M.E. and the American Institute of Electrical Engineers. Subject: "Influence of New Materials on Future Design," by R. C. Bergvall, assistant to vice-president in charge of engineering, Westinghouse Electric & Manufacturing Co., Philadelphia, Pa.

Western Massachusetts. January 18. Highland Hotel, Springfield, Mass. at 6:30 p.m. Subject: A talk on a restricted subject by Prof. Paul H. Nelson, University of Connecticut, Storrs, Conn.

Candidates for Membership and Transfer in the A.S.M.E.

THE application of each of the candidates listed below is to be voted on after January 25, 1944, provided no objection thereto is made before that date, and provided satisfactory replies have been received from the required number of references. Any member who has either comments or objections should write to the Secretary of The American Society of Mechanical Engineers immediately.

KEY TO ABBREVIATIONS

Re = Re-election; Rt = Reinstatement; Rt & T = Reinstatement and Transfer to Member.

NEW APPLICATIONS

For Member, Associate, or Junior

BAIRD, WALTER G., Binghamton, N. Y.
BALTON, HERMAN, East Orange, N. J.
BASUINO, FRANCIS M., JR., Brooklyn, N. Y.
BENGER, F., Montreal, Que., Canada
BERNAUER, RAYMOND O., Milwaukee, Wis.
BERTELSEN, ALBERT N., New Orleans, La.
BERTRAM, E. A., Hartsdale, N. Y.
BOOTH, JAMES H., Detroit, Mich.
BOWEN, H. B., Montreal, Que., Canada
BOYD, B. E., Newark, Ohio
BOYD, LEE R., Mansfield, Ohio (Rt & T)
BRANIGAN, GEO. F., Peoria, Ill.
BROWN, WM. W., Detroit, Mich.
BUCKMINSTER, LLOYD, Southbridge, Mass.
BURGER, WM. J., Cleveland, Ohio (Rt)
BYRNE, WM. H., Long Island City, N. Y. (Rt & T)
CAMPBELL, LEVIN H., JR. (GEN.), Washington, D. C.
CAPES, FRANK R., Jacksonville, Fla.